The White Paper

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Phyzseek: Sustainable High Intensity Functional Training (SHIFT)

At Phyzseek, our goal is to enhance the functional longevity of everyday athletes who want to get into the best shape of their life. Our focus has always been on bringing sustainability to high intensity workouts. By lowering injury risk to a realistic minimum, we strive to enable people to excel at many of their favorite activities even as their bodies change with age. We recognize that not everyone is capable of engaging in highly technical and potentially dangerous power lifting, nor do most people care about or even have the time to become an elite athlete. However, almost everyone wants to look better and needs help getting and staying motivated to improve their fitness, maintaining and enhancing long-term daily function, and improving their overall health. Welcome to our world, a new world born from and embodied in Phyzseek's ***Sustainable High Intensity Functional Training (SHIFT)*** Program!

Goals of Phyzseek's SHIFT Program

Our goal at Phyzseek was to develop a fitness program that is not only highly effective and time-efficient, but also moderates the potential of injury by taking into consideration the user's capabilities and pre-existing limitations. We designed Phyzseek to be **sustainable** for the everyday athlete whose primary objective is learning and participating in time-efficient and effective high intensity workouts which:

- Help to control weight and reduce body fat
- Aid in significantly improving overall health
- Maintain and enhance long-term daily function
- Reduce the potential to cause new injuries or aggravate pre-existing injuries
- Motivate people to consistently workout with the intensity needed to get transformative results, even when working out alone

Underlying Principles of the Phyzseek SHIFT Program

To ensure that we achieve our goals, we developed key principles based on a recognition of human variability. These principles form the foundation of Phyzseek's ***Sustainable High Intensity Functional Training (SHIFT)*** Program:

(1) An effective training program targets all three of the body's metabolic pathways – the phosphagen, glycolytic (anaerobic), and aerobic energy systems. High intensity training (HIT) is the most effective and time-efficient method to generate **metabolic adaptations** that produce transformative fitness results and improve important health parameters.

(2) An effective workout program recognizes that people are unique and require a diverse series of behavioral modification and motivational strategies in order to help overcome barriers to begin and sustain a fitness program. Balanced **workout routine variability** prevents boredom, decreases the chance of overuse injury and helps improve daily function. However, excessive variability impedes the development of proficiency, which is needed to reduce injury potential and enhance a person's level of motivation.

(3) An effective workout program recognizes that an individual's body changes with age. **Normal aging** causes a loss of Type IIa muscle fibers, a linear decline in $VO2_{max}$ and cardiac output, a loss of coordination and balance due to neurological changes, and muscles, tendons, bones and ligaments that become more prone to injury. Functional longevity can be achieved through balanced development of large muscle groups across multiple major joints.

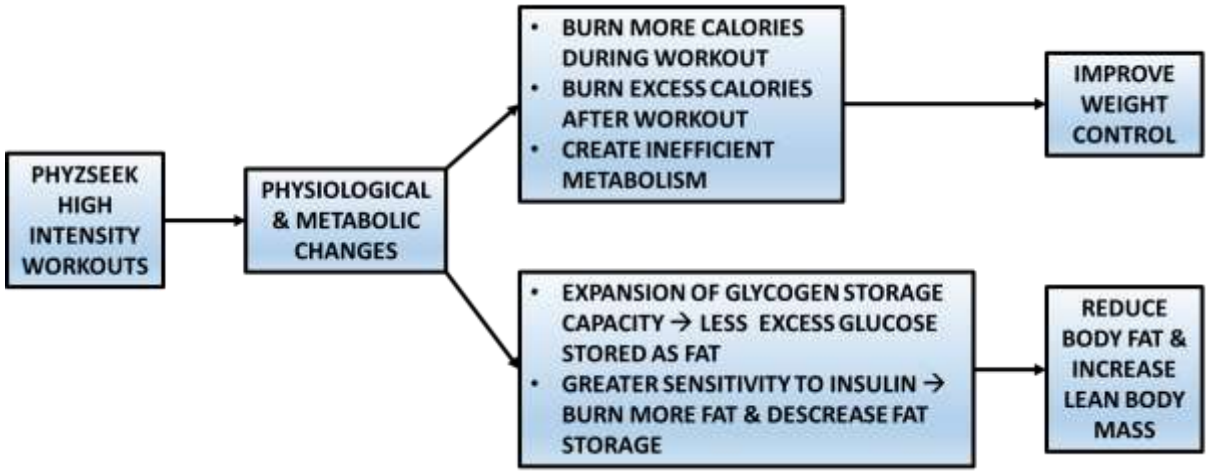
(4) An effective workout program recognizes that lifting heavy weight while fatigued, particularly when performing highly technical movements, significantly increases the chances of injury and is a major threat to sustainability. Structural dysfunction and pre-existing injuries are subject to exacerbation by heavy load exercises thereby increasing the likelihood of injury. HIT regimens result in significant bodily fatigue even for an elite athlete, thus making the use of heavy weights and highly technical Olympic lifts more likely to result in injury due to the loss of proper form**.** Our method uses primarily **high rep/low weight and body weight exercises** to achieve strength improvements, power gains, muscle endurance as well as better balance and coordination.

(5) An effective workout program recognizes that pre-workout warm-up regimens may help to reduce the chances of injury, improve workout performance and aid in recovery. **Recovery periods** are crucial for the sustainability of any training program, especially HIT, and importantly, the time required to recover increases with age.

Better Weight Control & Lower Body Fat

Most people's primary reason for starting a fitness regimen is to better control weight and to improve the way they look. Phyzseek workouts increase your body's ability to control weight by burning a greater amount of fat and calories in addition to reducing the storage of excess calories as fat. The direct result is an improvement in lean body mass, a reduction in body fat percentage and a greater ability to control your weight.

Figure 1:

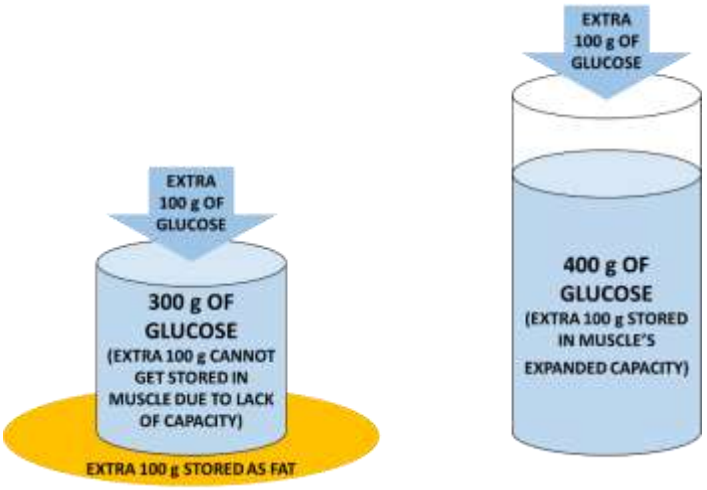


Phyzseek will drive your body to undergo several physiological and metabolic changes to accomplish this goal. First, your body will increase its capacity to store more glucose in the form of glycogen, which is important because less glucose will be available for eventual fat storage. Second, your body will become more sensitive to insulin, which will help you to burn a greater amount of fat as energy and to decrease the storage of excess calories as fat. Third, you will not only burn a significant number of calories during each workout but you will also continue to burn additional calories for several hours after you train.

Greater Glycogen Storage Capacity Can Help Decrease Your Body Fat Percentage

When we eat carbohydrates, our bodies digest them into simple sugars such as glucose. Glucose is then used by the body as fuel for normal function and during exercise. If your body doesn't utilize all of the glucose then it gets stored as glycogen in muscle and in the liver; however, there is limited storage capacity. Therefore, if there is no longer space to store the glucose as glycogen the excess can be stored as fat, or by stimulating a spike in insulin, can cause your body to hold on to more fat. Either way, too much glucose in your blood on a chronic basis is a bad thing that causes you to have a higher body fat percentage.

Figure 2:



The high intensity training program of Phyzseek quickly depletes glycogen stores (and by default glucose stores) because your body uses it up to maintain intense exercise. Research shows that glycogen depletion occurs quickly with high intensity exercise (Vallestad, 1985 & Fournier, 2004), particularly when associated with high reps, low weight and very little rest (Gollnick, 1974 & Buitrago, 2012) between sets. One of the amazing things about your body is that it adapts in order to continue working. In this instance, since your body does not want to run out of glucose as a fuel, it will adapt by expanding the glycogen storage capacity of muscles by as much as 100% (Bergstrom, 1966 & Nakatani, 1997). In doing so, it becomes more difficult for you to exceed the newly expanded storage capacity unless you dramatically increase your carbohydrate intake. Thus, it becomes less likely that you will have excess glucose in your blood which would cause you to hold on to more fat.

Greater Insulin Sensitivity Can Make You Leaner

Insulin is a key hormone responsible for regulating your blood glucose levels. As blood glucose rises, the amount of insulin secreted also increases while the opposite is true as blood glucose declines. Insulin acts to reduce your blood glucose through multiple different mechanisms including a metabolic shift toward using more glucose for fuel instead of fat. It also acts to reduce the amount of fat used for fuel and increases the amount of fat that gets stored. Thus, more insulin is bad.

Phyzseek's high intensity training program causes your body to become more sensitive to the effects of insulin through multiple adaptations in glucose transport and metabolism (Goodyear, 1998, Holloszy, 2005 & Hayashi, 1997). As a result, lower insulin levels are needed throughout the day. Lower insulin levels result in less fat getting stored and more fat being used as fuel, resulting in a leaner body. Perhaps more importantly, research (Dube, 2012) shows that high intensity exercise can reduce the risk of and maybe reverse Type II diabetes, which is due to insulin insensitivity.

Greater Caloric Burn

Everybody knows that eating too many calories relative to the number of calories you burn daily can result in weight gain. While the most effective way to control weight is to cut your caloric intake, exercise is very important to increase the number of calories you burn each day. If the number of

calories your body uses for normal daily function and during exercise is greater than the number of calories you take in through eating then you will lose weight.

High intensity exercise achieves this goal through three primary mechanisms: (1) your body will utilize a lot of calories while exercising, (2) you will continue to consume additional calories after your workout also known as EPOC (Excess Post-Exercise Oxygen Consumption), and (3) Phyzseek workouts are designed to create an *inefficient* metabolism by training your anaerobic system.

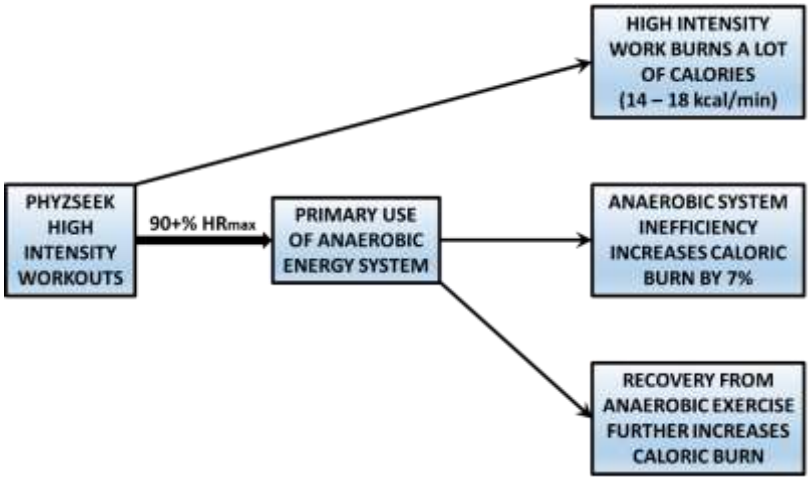
Each high intensity Phyzseek workout, which includes aerobic and resistance exercises, will burn a significant number of calories in a short period of time (Falcone, 2015). The workouts are designed to burn between 14 and 18 calories per minute depending on the individual and the intensity level they achieve. With the average workout lasting between 20 and 40 minutes, you should expect to burn 280 – 720 calories per workout.

One of the added benefits of the Phyzseek high intensity training program is that your body will remain metabolically hyperactive even after your workout (Barsheim, 2003 & LaForgia, 2006). Because of the high intensity nature of the program, your body will be working at an oxygen deficit. As a result, after the workout, your body must re-pay that debt by returning itself to its prior state. As it does so for the next several hours, your body will become hypermetabolic, burning more calories than it normally would in the resting state. As a result, you can burn many more calories even when the workout is over.

One of the other interesting yet counterintuitive benefits of the Phyzseek training program is that it causes your body's metabolism to become more *inefficient*. While inefficiency may sound like a bad thing in most cases, it actually provides a major benefit to those trying to control their weight and to reduce body fat.

An efficient body was necessary when food was scarce as it was in early man. But, with too much food available and too many calories consumed by the average person, as exhibited by the massive global obesity epidemic, an inefficient metabolism is better in today's world unless of course you are a marathoner or high endurance athlete.

Figure 3:



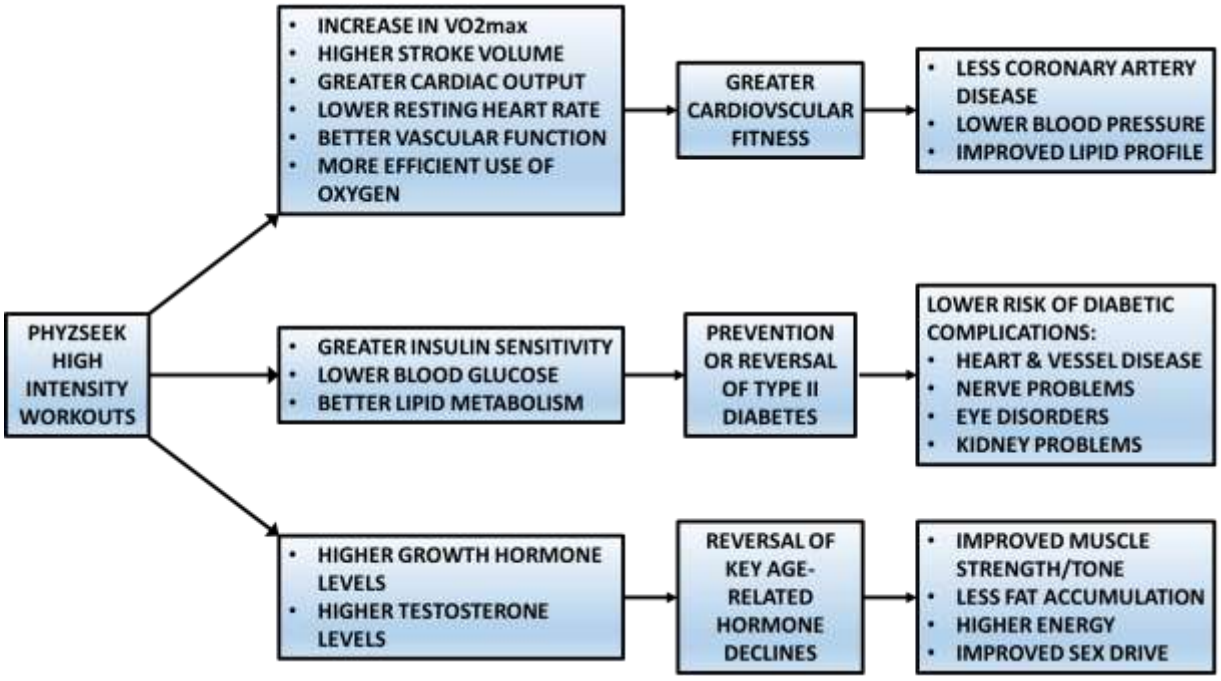
The Phyzseek workouts cause your body's energy production system to preferentially operate anaerobically (without oxygen) as opposed to aerobically (with oxygen). Anaerobic energy production is

very inefficient as compared to the aerobic kind. It requires the use of more calories (more of your daily food intake) to produce the same amount of stored energy. In other words, as you increase the intensity of your workout as measured by your percentage of heart rate max and your metabolism shifts increasingly towards the anaerobic energy system, you not only burn more calories due to the increase in work but you also burn extra calories because of the inefficiency associated with anaerobic metabolism (Scott, 2005). For example, in advanced users, we recommend an intensity of 90+% of your heart rate max, which results in an **extra 7%** of calories being consumed. In addition, as your body recovers from operating anaerobically, particularly converting lactate to glucose through gluconeogenesis, you burn even more calories. Therefore, as your body uses the anaerobic energy system to a greater degree, you will burn significantly more calories than you would if your body was operating aerobically, i.e. more efficiently. Sparing you the details, which we provide in a blog titled, "*Has Evolution Made Us Fat?*" the net benefit is that you will burn more calories each day and fewer calories will be stored as fat. It will be easier to lose weight and your body fat percentage will decline.

Improve Overall Health

Approximately 250,000 deaths per year in the US can be attributed to a lack of regular physical activity. So, it is obvious that all people should strive to improve the status of their overall health through exercise. Phyzseek's high intensity functional fitness program can help improve multiple cardiovascular system parameters, not only reduce but potentially reverse type II diabetes, reverse and prevent obesity (see above), and increase key hormones that normally decline with age.

Figure 4:



Better Cardiovascular Fitness Can Lead to a Longer Life

Regular physical activity has been associated with improving various measures of cardiovascular health. In general, more active or fit individuals tend to develop less coronary artery disease, maintain lower blood pressure, and have better blood lipid profiles. Reducing these risk factors, decreases the chances that they will have a heart attack or develop a stroke. However, despite these facts, less than one-third of Americans meet the minimum recommendation for physical activity.

Many people are under the misimpression that cardiovascular fitness can only be achieved through long endurance activities. However, current exercise physiology research consistently shows that high intensity training, such as that provided in the Phyzseek program, is just as good if not better, and accomplished in a shorter period of time, at increasing $VO2_{max}$, which is a key indicator of cardiovascular fitness (Helgerud, 2007). An improvement in $VO2_{max}$ can be very important for living a longer life. A large study by Kessler in 2012, showed that a low $VO2_{max}$ was predictive of cardiovascular-related death. And, another study by Blair from 1996, showed that, irrespective of other risk factors, moderately or highly fit people, as indicated by $VO2_{max}$, were more protected from death than less fit individuals.

The high intensity workouts provided by Phyzseek are designed to help improve cardiovascular health parameters. Numerous studies have now shown that high intensity exercise can increase important

cardiovascular metrics such as $VO2_{max}$, stroke volume, cardiac output, reduce resting heart rate, improve vascular function and enhance the body's ability to move and use oxygen throughout the body. Importantly, it can also slow the normal age-related decline in cardiac output and $VO2_{max}$. The net effect is a stronger heart that is less susceptible to disease with the potential to live a longer, healthier life.

Greater Insulin Sensitivity Reduces the Risk of Diabetes

Diabetes affects 29 million Americans and is a leading cause of death. As we detailed in the above section related to weight control, insulin is a key hormone responsible for regulating blood glucose. Type II diabetes occurs when your body becomes less sensitive to insulin resulting in a rise of blood glucose, which can have many harmful effects on your body such as heart and blood vessel disease, nerve problems, eye issues and a loss of kidney function.

Phyzseek's high intensity workouts help your body to become more sensitive to the effects of insulin through multiple adaptations in glucose transport and metabolism (Goodyear, 1998, Holloszy, 2005 & Hayashi, 1997). High intensity exercise can have a beneficial effect on both normal people and those with insulin resistance. The workouts act to increase glucose uptake by stimulating muscle GLUT-4 (glucose transporter protein) translocation, which has the effect of increasing the amount of glucose that is transported from the blood into muscles. High intensity exercise also acts to reduce the amount of glucose that is produced and released by the liver while also improving lipid metabolism.

High Intensity Exercise Helps Return Testosterone & Growth Hormone to More Normal Levels

As people age, testosterone and growth hormone levels decline each year. Testosterone levels peak when men are in their 20s but begin to decline starting at age 30 by about 1 – 2% per year. As testosterone levels decline, men begin to witness a decrease in muscle strength and tone, fat can accumulate around their mid-sections, energy levels dip and sex drive can be adversely affected.

Research has consistently shown (Hackney, 2012) that exercise results in a significant increase in levels of testosterone. Studies have demonstrated that the fastest and best way to produce the greatest testosterone response is by doing high intensity exercise, similar to the Phyzseek regimen. In addition, other studies have shown that high intensity exercise can also moderate or even prevent testosterone's age-related decline.

Growth hormone is released from the pituitary gland in a pulsatile fashion throughout the day. Growth hormone increases during childhood, peaks in puberty and then declines starting in middle age. Growth hormone boosts protein production and promotes the use of fat. Obviously, growth hormone has important benefits that begin going away as we age.

There is a well-recognized exercise-induced growth hormone response (Godfrey, 2003). The mechanism appears to include stimulation by epinephrine and norepinephrine as well as in response to increases in blood lactate levels. According to certain research, there is an intensity threshold for the growth hormone response to occur. Data (Felsing, 1992) suggests that exercise intensity above the lactate threshold for a minimum of 10 minutes appears to produce the largest stimulus for growth hormone secretion. In addition, exercise above the lactate threshold amplifies the pulsatile release of growth hormone for 24 hours, even at rest. Phyzseek's regimen focuses on producing a large lactate response, thus it is likely to have a beneficial effect on growth hormone levels that are accompanied by significant physiological benefits.

Enhancing Functional Longevity via Functional Fitness

Another goal of the Phyzseek training program is to maintain and enhance functional longevity, which is a benefit that tends to be underappreciated by most young people. It isn't until they have trouble doing things later in life that they recognize the benefits of greater daily function. The time to start focusing on functional longevity is not after you've lost it. It's throughout life so that you never lose it.

So, what exactly is functional longevity? The best way to define the term is having the ability to remain highly functional into your old age, which includes maintaining strength, muscle control, balance, coordination, and having the ability to continue exercising and participate in activities late into life.

At Phyzseek, we recognized early that some widely used high intensity training programs are very effective at controlling weight and reducing body fat but can result in injuries and create problems that will reduce future long-term function. Therefore, Phyzseek was designed to capture the benefits of high intensity training while reducing the potential for injury and increasing functional longevity.

Functional longevity is directly related to functional fitness, which trains your muscles to help you do everyday activities more efficiently and with less effort. Functional training involves using muscles in a coordinated way, typically large muscles across multiple joints, and emphasizes core stability. Functional training involves neuromuscular exercises that help to maintain balance, coordination, gait and agility, which are especially important as people age.

Each Phyzseek workout is designed to hit the major muscle groups in a coordinated and balanced fashion across major joints. The goals are to stabilize major joints, prevent pain associated with a lack of muscle balance across those joints (Page, 2011), increase resistance to muscle fatigue, improve neuromuscular recruitment for better balance and strength while at the same time reducing wear and tear associated with aging.

Muscle Strength & Balance Are Key to Reducing Injuries as well as Aches & Pains

A typical Phyzseek workout focuses on the quads, gluts, hamstrings, core (front and back), and upper body (front and back). The concept is to strengthen large antagonistic muscles (muscles that perform opposing function) in a balanced fashion in order to stabilize joints to enhance functional longevity and to prevent pain that tends to occur when one muscle group is much stronger than its antagonistic set of muscles. In addition, prescribed exercises aim to move joints through their full range of motion to improve flexibility and mobility.

For example, a lot of back issues are due to strong quads and hip flexors but weak hamstrings and gluts. The lack of balance across the pelvis can put pressure on the spine, causing certain stabilizing back muscles to spasm. Coupled with a weak core, back problems are a major concern, especially as people age. Many neck problems occur because people tend to have strong muscles across the front of their bodies but weak ones across the back. As a result, pressure can be put on the cervical spine, which may push on nerve roots and cause neck pain as well as radiculopathy.

Building Strength and Power with Appropriately Chosen Exercises and Workouts

As we age, we lose muscle strength and size due to a decrease in the number of Type II (fast twitch) muscle fibers. Type II fibers are necessary for strength and power, thus as we lose them with age, we

also lose the ability to produce force and the ability to perform a certain amount of work in a period of time. Fortunately, research (Thompson, 1994, Hagerman, 2000 & Hikida, 2000) shows that the gradual loss of Type II muscle fibers can be stopped through high intensity resistance exercise. In particular, this workout regimen can stave off the loss of Type IIa fibers, which are considered a blend of slow twitch (endurance) and fast twitch (strength and power) fibers. Therefore, high intensity resistance training can improve strength, power and muscle endurance.

Phyzseek workouts focus on all muscle fiber types and energy systems through its three primary workout types – Intervals, Lactic Loading and Endurance – with a particular focus on aerobic/glycolytic Type IIa fibers. The workouts maintain and promote muscle strength and power by using both weighted and body weight exercises that are performed with very little rest. By doing so, Type IIa fibers are targeted. The workouts consist of light resistance exercises performed in a high intensity fashion, which is a very time-efficient way to build strength. In addition, many of the exercises, such as kettlebell swings, thrusters and toes-to-bar, require explosive movements which help to build power in a variety of muscles.

Stronger Muscles That Are More Resistant to Fatigue While Experiencing Less Wear & Tear

Phyzseek workouts strengthen muscles, not through heavy Olympic lifting, but by prescribing more repetitions of lighter weight. These repeated movements require several muscle groups that reach across multiple joints. The body becomes forced to expand neuromuscular recruitment, which increases strength and improves coordination as well as balance. While bulkiness is not a goal, muscles will get stronger, toned and leaner.

Phyzseek workouts help muscles to become more resistant to fatigue, which is accomplished in a variety of ways. First, high intensity training increases the number and quality of mitochondria within muscles, which are the energy producing organelles within cells (Vincent, 2015 & Jacobs, 1985). With more mitochondria that can produce more energy, muscles are able to perform work for a longer period of time, thus increasing muscle endurance and stamina. Second, Phyzseek workouts boost the ability of muscles to deal with lactate (Gopa, 2014 & Brooks, 2009), which increases during strenuous anaerobic exercise and is indirectly associated with muscle fatigue. Because muscles are bathed in lactate during the workouts, the body must learn to adapt. It does so by learning to use lactate as fuel, convert lactate to glucose and increases its ability to buffer hydrogen ions (muscle burn) which rise with increasing levels of lactate. Third, better cardiovascular fitness will enhance your body's ability to move and utilize oxygen, which also serves to reduce fatigue.

Another major focus is to reduce wear and tear so that long-term function is maintained. Phyzseek achieves this goal by encouraging the use of lighter weights, prescribes short-duration workouts and through variable but consistent exercise selection allows you to develop proficiency, thus reducing the likelihood of injury.

Workout Sustainability is Only Achievable by Minimizing Injuries

When prescribing a fitness program, it is crucial to ensure that the sought after health improvements do not jeopardize function due to injury. While no exercise program has a zero chance of injury, it is important to ensure that its rewards significantly outweighs its risks (Fisher, 2014). A fitness program is not sustainable if it consistently causes new injuries, either nagging or more severe, or aggravates pre-existing injuries, such as shoulder, neck, back or knee problems. Injuries typically occur when people do not use the correct form when exercising, they perform repetitive motions that are associated with overuse injury or they do not allow for adequate recovery between workouts.

Using Proper Form Helps Reduce the Risks But it Isn't Possible for Everyone

Improper form is a major reason for exercise related injuries (Hart, 1994). They can occur when a person has not been well coached on how to perform an exercise properly, they have pre-existing structural dysfunction that limits their ability to do certain exercises the correct way, they become overly fatigued during the workout or the weight they are using is too heavy for them. Research shows that any combination of the above issues, such as fatigue combined with heavy weight, can compound the risk of injury.

Proper form must be taught from the beginning of any fitness program. Not until a person can perform exercises properly should they focus on increasing intensity through a higher load or faster pace. Without perfect form, many exercises can cause injuries or aggravate pre-existing ones. Phyzseek preaches form over speed – ALWAYS -- and provides detailed exercise videos so that users can emulate proper form. In addition, by limiting the number of prescribed movements, users have a better chance of developing proficiency.

Proper Form is NOT Always Possible

However, even if someone receives great coaching about proper form, it does not ensure that proper form can necessarily be attained. With structural dysfunction and pre-existing injuries, many people cannot perform certain exercises properly even if they are trained to use correct form (Lewkowski, 2015 & Fisher 2014). Prior injuries and structural dysfunction become more common as we age due to genetics, gravity, poor posture or from other normal daily activities, all of which limit certain motions and reduce mobility. Joint, tendon, and muscle problems prevent load (weight) from being dissipated safely without creating undue stress that increases the chances of injury. For these people, it is best to reduce the chances of injury by limiting the complexity of movements, reducing load and by providing alternatives to prescribed exercises.

Phyzseek's training program prescribes workouts that produce balanced muscle development of antagonistic muscle groups across multiple joints thereby stabilizing and protecting those joints, which helps to reduce future injuries. To help with pre-existing dysfunction, our program provides and recommends pre-workout warmups to help mobility and flexibility. To further reduce the potential of injury, Phyzseek does not prescribe highly technical Olympic lifts, such as clean and jerks or snatches, and does not recommend heavy weights. For people with pre-existing issues or structural dysfunction, the Phyzseek app provides easy-to-view alternatives to each exercise so that users can easily modify the daily workouts.

Workouts that Generate Significant Fatigue Must Accommodate an Increased Potential of Injury

Fatigue in itself is not a bad thing. Workouts that produce fatigue force the body to physiologically adapt, which helps to foster health and fitness improvements. But, fatigue can be an important reason that people sustain injury. Fatigue becomes particularly crucial when movements are complex and heavy weight is being lifted. A person's ability to perform a movement with perfect form declines as the level of fatigue increases during a workout. Obviously, in this situation if the exercise requires a complex movement then the likelihood of proper form declines further. And, as the weight being lifted increases, the ability to maintain form declines and the chances of injury increase (Fisher, 2014).

Phyzseek's high intensity workouts will generate fatigue. As a result, there is the potential that form may suffer for some people. Given this reality, in order to tip the balance so that the benefits of the program continue to outweigh its risks despite fatigue, we have eliminated many complex movements including highly technical Olympic lifts and do not recommend heavy weight. Instead, we prescribe many exercises that can be done using body weight, such as pushups, burpees and sit ups. And, when we prescribe exercises that use weight, we recommend lifting light weight (typically 30 – 40% of one's body weight). With higher reps and lighter weight, our goal is to spare joints while promoting muscle strength and endurance.

Prescribing Repetitive Motions is a Balancing Act

Repetitive motion can cause overuse injury. Many athletes that perform the same motion over and over can develop injuries associated with that motion. For example, pitchers can develop shoulder and elbow injuries due to throwing the ball over and over. However, repeating certain motions can also allow people to develop proficiency, which is associated with greater personal satisfaction and can also reduce the likelihood of injury as they develop better form.

The Phyzseek workout regimen prescribes a variety of movements combined in various ways in order to make the workouts challenging and to keep them interesting and fun. In addition, the variety reduces the potential for overuse injury. However, we limit the number of exercises that are prescribed so that people can develop proficiency. As people develop proficiency, they begin to enjoy the workouts more and proper form is more likely to be maintained. Thus, they are more likely to stick with the program and they are less likely to develop injuries.

Recovery is Imperative & the Time Needed Varies by Individual

Overtraining is a common problem, especially for newbies that are excited about a new workout program. Without adequate recovery periods, the body will breakdown and performance will suffer. Recovery gives the body time to repair itself thereby allowing it to adapt and improve. It also reduces the chance of injury and decreases the potential for longer term dysfunction. Different people require different amounts of time to recover (Lewkowski, 2015). There are several different factors that determine the necessary amount of recovery time – genetics, age and the type of workout program being done.

Certain people can recover quickly while others may take longer. The difference may simply be due to genetics. But, more definitively, as people age, they require more time to recover. Many young people can train effectively multiple days in a row but older people (35+ years old) may require a couple of days of recovery between workouts. Heavy weight, training multiple large muscles and a focus on fast twitch

fibers further necessitates a longer recovery period. As we've laid out, the recovery period depends on multiple factors so no specific guidance for rest periods are appropriate for all people.

The Phyzseek workouts are intense, tend to hit multiple large muscles and are designed to train type IIa (fast twitch) muscle fibers in particular. Therefore, it is crucial that participants maintain workout schedules that provide for adequate recovery periods. Each individual needs to "listen" to their body and recognize that if they are getting older, work out intensely, and are hitting multiple large muscle groups then they will need a longer time to recover. We recommend a workout schedule of 1 - 2 days per week for people new to the program and no more than 3 to 4 times per week for advanced athletes. In addition, we highly recommend active recovery on days off that include yoga, long slow runs and/or stretching. We also highly recommend that everyone gets adequate sleep to help in the recovery process.

Motivation to Work Out Consistently with Intensity to Get Results

A fitness program is only effective if people actually do it. It is certainly easy for people to say they are going to get in shape, but to actually get off the couch, design an effective training program, work out consistently and with the intensity needed to get results in addition to staying the course, it requires a huge amount of motivation. Importantly, dissimilar people require different behavioral modifications and motivational techniques to succeed. The Phyzseek App uses multiple different features to address many of the common potential stumbling blocks to starting, following and getting results in a fitness program.

Phyzseek Helps People to Get Started with a New Fitness Program

The Phyzseek app makes it easier to get started by lowering a few common barriers to beginning a fitness program. The app is easily downloaded from the App Store and users can sign up for a 30-day free trial without having to input their credit card numbers. Users do not need to buy exercise equipment or belong to a gym. If they don't know how to do some of the exercises in a workout, the App provides detailed exercise demonstration videos. The videos not only help the user to do the workouts properly so that they can develop proficiency but helps to reduce their chances of injury. In addition, if the user does not have certain equipment available to them or some of the exercises are too difficult then the App will provide suitable alternatives and modifications that can be easily, and in some cases automatically, substituted into the workout.

A New Workout is Provided Each Day, Eliminating Daily Decisions

Most people have no idea how to design an effective training program. To help eliminate daily workout decisions, Phyzseek pushes a new, easy-to-follow, workout every day directly to the user's device. The science-based workouts, designed by a medical doctor who is also an ACSM certified personal trainer, are intended to transform the user's body into a metabolic machine, which helps to quickly produce results. Results are important for people to sustain the motivation to continue participating in a fitness program.

Working Out Consistently is Crucial to Success

If Phyzseek just merely provided workouts then there wouldn't be a very compelling reason for people to continue using it. Perhaps most importantly, Phyzseek's features motivate users to consistently work out. Every single day they receive a highly variable, time-efficient, daily workout or PhyzWOD (Phyzseek Workout of the Day). Including the warm-up and cool-down, most workouts can be completed in 30 – 45 minutes, depending on the specific routine. For people who need social support, they will be able to connect with their PhyzTeam. The PhyzTeam consists of 7 other Phyzseek members. The team members will hold them accountable so that they work out each day, provide social support and foster friendly competition further driving their success. In addition to being able to communicate with their PhyzTeam, users can also participate in the Phyzseek on-line fitness community to get further support, encouragement and fitness tips.

High Intensity Even When Working Out Alone

In addition to consistency, the App motivates people to work out with the high intensity needed to produce transformative results even when working out alone. The app is designed with a Pacer that is pre-programmed by the user prior to every workout. The user determines how fast they'd like to do the workout, how many reps they want to do or how many rounds they strive to perform. Then, during the

workout, the Pacer will continually tell the user what exercise, what rep and what round they need to be doing at each time point to achieve their pre-programmed goal. The Pacer acts like a personal trainer providing support and applying gentle pressure while the user works out. In addition to the Pacer, users can use a heart monitor that links via Bluetooth to the app. Through color-coded prompts, the app continually informs users if they are achieving the intensity needed to get the most out of the program.

The App Will Help Maintain Consistency

The Phyzseek app helps user to maintain a consistent workout regimen. There are several ways the App tackles this important objective. On an individual level, the App provides proof of results by helping the user to easily log and track workout performance and fitness progress. By constantly receiving personal feedback that shows success, the user is more likely to want to continue with the Phyzseek program. Equally important, the user can compare results and their fitness level with other users of the App across the entire globe. Friendly competition serves as a significant motivator for many people. But, if the user responds better to being social over being competitive, Phyzseek's online fitness community provides them a venue to brag about their progress as well as a way for them to get social support. Phyzseek provides the necessary tools for users to become successful with their health and fitness goals.

The Training Regimen

Using the FITT Principle to Develop the Phyzseek Program

Phyzseek used the FITT principle to develop its high intensity training program. F stands for frequency, which refers to how often somebody should exercise. I represents intensity, which is the amount of effort that must be invested during each workout. T stands for Time, which is how long each session should last. And, the other T represents type, which is the kind of exercise that should be performed.

Frequency Depends on Many Individual Factors, But Recovery is Crucial for Everyone

Exercise involves stressing the body to the point that it must physiologically adapt by rebuilding and repairing. But, the repair process requires adequate rest otherwise there is a risk of overtraining, which can have significant negative effects, such as a decrease in performance and the development of injuries. High intensity training can be very stressful on the body, which is why it is so successful at causing metabolic adaptation. But, as a result, longer recovery periods are required than with other programs. We recommend that for people that are new to the program, they workout only once or twice per week, at most. As their bodies become more accustomed to the workout regimen, they can increase the frequency to 3 or 4 times per week. Frequency will be determined by many factors (detailed above), but listening to your body is always a good rule of thumb. On off days, we recommend active stretching and/or low-intensity workouts.

Maintaining Intensity is the Basis of Phyzseek

The Phyzseek fitness program is focused on intensity. By definition, as a high intensity training program, it requires a high level of effort invested during each workout. Data suggests the higher the intensity, the greater the adaptation and benefits. For example, research indicates that higher intensity is associated with greater improvements in $VO2_{max}$ and cardiac output. For advanced participants, we recommend maintaining a heart rate of greater than 85% of their heart rate maximum. For less advanced people, we recommend maintaining a heart rate of greater than 75% of their heart rate maximum, increasing the intensity as their fitness improves. Intensity should also be maintained for workouts that aren't as heart rate intensive, such as interval workouts. During interval workouts, each round and cycle should be performed with as high intensity as possible for the entire round and potentially to muscle failure.

Time Invested Varies by Workout

As a high intensity program, many of the Phyzseek workouts are of relatively short duration. Certain highly intense Phyzseek workouts may only last 18 minutes while other could take more than 30 minutes to complete. But, few workouts should take more than 45 minutes. However, as someone new to the program, they should not worry about the time commitment as much as focusing on exercise form. Form always trumps time.

The Type of Exercises

As we detailed in prior sections, the Phyzseek workouts consist of exercises that focus on all of the large muscle groups of the body that traverse multiple joints with particular focus on the core (front and back), legs (front and back) and the upper body (front and back). The concept is to stabilize joints so

that the workouts can be done on a sustainable basis. Each exercise group consists of a fixed number of movements as to allow people to develop proficiency. While we divide the exercises by muscle group, many exercises overlap and may actually fit into all of the groups.

Table 1:

Core		Legs		Upper Body		Full Body	
Weighted	***Body-Weight***	***Weighted***	***Body-Weight***	***Weighted***	***Body-Weight***	***Weighted***	***Body-Weight***
Wt'd Sit Ups	Toes-to-Bar/ Knees-to-Elbows	Romanian Deadlifts	Air Squats	Shoulder Presses	Pull Ups	Thrusters	Burpees
	V-Ups	Front/Back Squats	Jump Squats	Chest Presses	Ring Rows	Kettlebell Swings	Mountain Climbers
	Sit Ups	Sumo Deadlift High Pulls	Lunges		Plank Rows	Wall Balls	Sprawls
	Roll Outs	Wt'd Lunges	Jumping Lunges		Pushups	Man-makers	Spiderman Pushups

In addition to the above weight bearing and body weight exercises, the Phyzseek program also uses cardio to either increase a workout's intensity, provide active recovery or to forge cardiovascular endurance. The cardio alternatives include running, rowing, biking and jumping rope. The app provides easy conversion of one cardio exercise to another as shown below.

Table 2:

	Conversion of Run to Other Cardio Exercises						
	meters				***miles***		
Run	**200**	**400**	**500**	**800**	**1**	**1.5**	**2**
Bike	500	1,000	1,250	2,000	2.5	3.75	5.0
Row	250	500	625	1,000	1.25	1.875	2.5
Jump Rope	160 jumps	320 jumps	400 jumps	640 jumps	1,287 jumps	1,931 jumps	2,575 jumps

Three Types of Workouts: Intervals, Lactic Loading & Endurance

The Phyzseek high intensity fitness program consists of three categories of workouts – Intervals, Lactic Loading and Endurance. We recommend that people perform workouts from each category in a balanced fashion so that the benefits of each are acquired. Each category contains a variety of workouts that target the body's energy systems in different ways. So, balance across the three workout types allows for physiological adaptation of all three energy systems. To capture measurable results, each workout is either performed for time, reps or rounds.

Intervals Help Develop Strong Lean Muscles with Endurance

The Intervals category involves a workout regimen whereby exercises are performed in a sequence that consists of a work period followed by a rest period. The full body exercises are grouped into cycles that

target specific muscle groups through weighted and/or body weight movements. By targeting large muscle groups across multiple joints, functional fitness is enhanced. Each Interval regimen includes between three and five cycles, depending on the time requirement of each cycle. Between each cycle, the athlete performs a moderately paced cardio exercise for 2 ½ minutes to allow for active recovery. Then, they begin the next cycle which consists of a new group of exercises sequenced in the same way as the first cycle.

The rest/work sequence may emulate the well-known Tabata workout, which consists of 8 rounds of a work period that lasts for 20 seconds followed by a rest period of 10 seconds. Or, the sequence may involve 60 seconds of work followed by 30 seconds of rest. Both sequences are full body workouts with or without weight that may result in muscle failure during each cycle, which helps to build strength and endurance. Depending on the sequence, a different anaerobic energy system is targeted. For the shorter 20/10 sequence, the phosphagen system is primarily targeted, which is the fastest of the metabolic systems to synthesize energy, while for the longer 60/30 sequence, the glycolytic system benefits the most.

There are several designs for Interval workouts.

Table 3:

Work/Rest Ratio	Rounds	Cycles	Muscle Groups/Cycle	Movement Sequence	Load
20/10	8	5	Single	Power/Active	Body Weight Only
20/10	8	5	Single	Active	Body Weight/Weighted
20/10	8	5	Antagonists	Active	Body Weight/Weighted
60/30	5	3	Multiple	Active Only	Weighted or Body Weight
60/30	5	3	Single	Active Only	Weighted and/or Body Weight
60/30	4 or 5	3 or 4	Antagonistic	Active Only	Weighted/Body Weight

Lactic Loading Helps Transform the Body's Metabolism

The lactic loading category causes the body to build blood lactate levels steadily throughout the workout. While historically lactate had been considered a worthless waste product that accumulates during intense exercise, it is actually a powerful stimulator for physiological adaptation. Lactate builds during lactic loading workouts because they are heavily anaerobic in nature, which drives lactate production. These workouts require people to perform a sequence of high intensity resistance exercises and cardio with very little rest between movements. Lactic loading workouts helps to rapidly deplete glycogen stores to forge expansion of glycogen storage capacity, which helps to decrease the likelihood that excess blood glucose will eventually be stored as fat, as previously detailed. In addition, by exceeding the anaerobic threshold for greater than 10 minutes, growth hormone secretion is stimulated.

Phyzseek uses several different exercises and sequences to accomplish the goal of lactic loading, but the workouts typically involve 4 to 7 different exercises that target all large muscles groups of the body. The variable sequence of exercises may end with a short run of 200 m or 400 m (or cardio equivalent) to

further drive blood lactate then the sequence is repeated multiple times. Each exercise is performed for a specific number of reps, either a fixed number for each exercise, a different number of reps for each exercise or for an increasing/declining rep count during subsequent rounds. The rep count can be low but would require a higher number of rounds to be repeated or the rep count may be high, which would require fewer rounds to be completed. Workouts with lower rep counts should be treated as sprints, which helps to build Type IIa muscle fibers, while those with higher rep counts tend to repeatedly push the individual's muscles to failure, which helps to build muscle strength and power.

AMRAPs involve performing as many rounds as possible for a specific sequence of exercises during a 24 minute period while Ladders involve a sequence of exercise with rep counts that decline from 10 to 1 during the workout. Card workouts use a deck of cards to randomly determine the rep count for each exercise that is determined by the suit of the card flipped.

Table 4:

Workout Type	**Number of Exercises**	**Reps**	**Sequence**	**Rounds**	**Run (or cardio equivalent)**
21-15-9	5 - 7	21-15-9	Declining	3	400 m at end of each round
Mixed Reps					
Fixed - Sprint	5 - 7	7	Fixed	7	No run
Fixed - Failure	6 - 7	30 - 50	Fixed	1 - 2	No run
Declining	4	25 → 10	Declining	4	400 m at end of each round
Increasing	5	6 → 24	Increasing	6	200 m + jump rope at end of each round
Increasing/Decreasing	6	10 → 20 →10	Increase/ Decrease	4	400 m at end of each round
Ladders	5	10 → 1	fixed	10	200 m or jump rope at end of each round
Cards	Depends upon suit of card	Depends upon number on card	random	52 cards in deck	No runs
AMRAP	6	10 - 15	Fixed or mixed	24 minutes	200 m or jump rope at end of each round

Endurance Workouts Target the Aerobic System…And, the Anaerobic System

Endurance workouts are designed to target the aerobic (oxygen-dependent) metabolic pathway, which helps to expand aerobic capacity. However, each workout also hits the anaerobic system as well, which counterintuitively can also expand aerobic capacity if the intensity is high enough. Endurance workouts contain runs of 1 – 3 miles focusing primarily on the aerobic system, which is a great method of targeting Type I (slow twitch) muscle fibers. Or, the workouts consist of shorter 800 m runs, which is right on the cusp of utilizing the aerobic and anaerobic energy systems equally, and a great way to target the Type IIa fibers we have highlighted in other areas of this White Paper. All of the runs are either followed by weighted or body weight exercises or the exercises are interspersed between runs. The Phyzseek 5k consists of 10 rounds of 500 m runs (or cardio equivalent) and 5 different core exercises after each run.

Table 5:

Workout Type	Number of Exercises	Reps	Sequence	Rounds
1 – 2 mile Run	2 - 9	10 -150	Declining	1 - 3
800 m runs				
Fixed	3	20	Fixed	4
Varied	4	20 → 5	Declining	4
500 m runs	5 x 2	10	Fixed	10

Sustainability is Maximized with a Proper Warm Up

As we mentioned previously, sustainability is a crucial aspect of any successful fitness program, which involves minimizing the incidence of new injuries and not aggravating pre-existing ones. Also, since many people have structural dysfunction that limits flexibility and mobility, which prevents them from performing exercises properly, we recommend a pre-workout warm up to help improve pre-existing issues and lower the likelihood of developing new ones such as muscle strains and tendonitis. Cool downs can also be used to prevent light-headedness after workouts due to blood pooling in the lower extremities.

Pre-Workout Warm Up

Prior to beginning each workout, it is very important to perform an adequate warm up to improve flexibility and mobility so that proper form is easier to attain and the potential for injury is reduced. In addition, evidence suggests that a warm up can reduce post-workout soreness. The warm up prepares the body for the workout by increasing the heart rate and improving blood flow to muscles and tendons. We recommend starting with low-intensity cardio (run, row, bike, jump rope) for 5 minutes to raise the heart rate and increase blood flow.

Following the cardio warm up, we recommend dynamic stretching to activate and warm up muscles through active motion, which helps to improve blood flow to muscles and tendons as well as to improve mobility and flexibility. Since each workout involves all major muscle groups, the warm up should include dynamic stretching of all major muscles and their attached tendons. Joints should be brought through their full range of motion. Phyzseek provides a video of an effective dynamic stretching routine,

but at a minimum, people can benefit from doing short, slow dynamic movements consisting of the exercises to be performed during the workout.

There is some controversy as to whether or not people should perform static stretching prior to a workout as well. Static stretching involves slowly moving muscles and tendons to their full length for a period of time to improve flexibility and joint mobility. Some research suggests that static stretching may reduce athletic performance due to a decrease in strength and power. And, there is little evidence that it reduces injury. However, we have found that static stretching of back, neck and core muscles, especially for older people, helps to reduce the potential for aggravating pre-existing issues associated with those body parts. Phyzseek provides videos of our favorite static stretches.

Post-Workout Cool Down

Following each workout, we also recommend a proper cool down. While studies have not supported the general belief that a cool down reduces muscle soreness, prevents injuries and aids in recovery, data does suggest that a cool down prevents the pooling of blood in lower extremity vessels, which can reduce post-exercise dizziness and fainting. Performing low intensity cardio after a workout for 5 – 10 minutes allows your body to slowly return to its resting state while maintaining adequate blood pressure.