

**The U.S. Army War College Guide  
To Executive Health and Fitness**

**William F. Barko and Mark A. Vaitkus  
Editors**

August 2000

# U.S. Army Physical Fitness Research Institute

\*\*\*\*\*

Mission: Prepare selected military, civilian, and international leaders to assume responsibility for health and fitness of the force, conduct health and fitness research of the over-40 population, and provide outreach programs benefiting the U.S. Army War College, the U.S. Army, and the Nation.

The Army Physical Fitness Research Institute is an integral part of the Army War College's educational, research, and outreach mission. Functions of the Institute include the following:

- Serve as the primary U.S. Army agency responsible for research on health and fitness of the over-40 population.
- Identify and evaluate new research methods for over-40 health and fitness in cooperation with other governmental, academic, and health care institutions.
- Provide technical educational programs and consultation to other national and international governmental agencies on over-40 health and fitness.
- Provide world class health and fitness assessments using state-of-the-art techniques and manage interventions aimed at reducing injuries and cardiovascular disease.

# CONTENTS

Acknowledgements . . . . .	v
Foreword <i>Redford B. Williams</i> . . . . .	vii
Chapter 1 The U. S. Army War College and the Road to Executive Health and Fitness <i>John Duncan, Mark A. Vaitkus, and William F. Barko</i> . . . . .	1
Chapter 2 Senior Leader Preparation for Mid-Life Challenges <i>Michael W. Parker, Mark A. Vaitkus, Carolyn Aldwin, Vaughn Call, and William F. Barko</i> . . . . .	23
Chapter 3 Cardiovascular Disease and the U. S. Army's Role in Combating It <i>Michael P. Brazaitis, Irwin M. Feuerstein, and Jerel Zoltick</i> . . . . .	41
Chapter 4 Mental Intensity and Your Heart <i>Jeffrey L. Boone</i> . . . . .	55
Chapter 5 The Killing Fields of Anger: Can Anger be Controlled? <i>Aron W. Siegman, Edward A. Franco, and Mark A. Vaitkus</i> . . . . .	73
Chapter 6 The Role of Sleep in Sustaining Individual and Organizational Effectiveness <i>Nancy J. Wesensten, Thomas J. Balkin, and Gregory Belenky</i> . . . . .	97
Chapter 7 Injury Control for Physically Active Men and Women <i>Joseph J. Knapik and Rebecca L. McCollam</i> . . . . .	119
Chapter 8 Eating for Performance and Health: The Nutrition Connection <i>Lori D. Hennessy and Gaston P. Bathalon</i> . . . . .	143
About The Authors . . . . .	187

## ACKNOWLEDGEMENTS

The Army Physical Fitness Research Institute wishes to thank Colonel Lloyd J. Matthews, U.S. Army Retired, for his dedication in editing this book. Special thanks go to Liz Morrow, Royce Shelton, Mike Chisick, and Julie Barko for the time and effort invested by each of them. Their dedication was paramount to the success of this book. Of course, many thanks go to U.S. Army War College students, without whom our research would not have been possible.

The Institute is also grateful to all those whose valuable contributions and thoughtful comments contributed to the overall concept of this book.

## FOREWORD

First year students at Duke University Medical School take a year-long course entitled "Introduction to Clinical Care." It is designed to begin the process of teaching students how to be a doctor interacting with patients. In years past, all the traditional topics were covered: taking the medical history, doing the physical examination, learning what various lab values mean—the nuts and bolts that all medical students think are the most important at this stage in their careers. At one of the meetings of this course this past spring, however, the new Dean for Medical Education, Dr. Russell Kaufmann, introduced a new topic in a rather startling way. "We will be teaching you about all the newest developments in molecular biology during your years here at Duke," he began. "But that's not all we want to teach you. We want to teach you also how to be happy, happy in your new roles—not only as a physician, but also as a husband, a father, a member of your local community."

The need for this new emphasis in medical education grows out of the many new forces that impinge on members of the medical profession—managed care, health maintenance organizations, new technologies, spouses who also work, children under new pressures to perform well in school, to name a few. The world physicians must negotiate today is not their father's world. Hence the need for explicit training in coping skills that will help them function effectively in today's more complicated environments.

Senior leaders in our armed forces may face many of the same pressures just described for members of the medical profession, and other pressures that are unique and add to the load—including frequent transfers, long separations associated with long deployments, and the need to maintain high morale in the enlisted ranks. These and many more are delineated by Colonel Barko and coauthors in this anthology, describing what he and his predecessors have learned in the innovative and forward-looking programs that have been in place for nearly two decades at the Army Physical Fitness Research Institute at the U.S. Army War College in Carlisle, Pennsylvania.

At a time when officers in the mid-ranks are leaving the services at an alarming rate, the need for a book like this one has never been greater. In chapters describing the mid-life challenges and developmental tasks senior leaders need to master, the physiological impact of stress on the heart, and the dangerous effect of anger on the cardiovascular system, the reader will gain new insights into the role stress can play in both their effectiveness as leaders and their own health. And in chapters on injury control, the role of sleep, anger management, and nutrition, readers will learn some important strategies for coping with these stressors.

The chapter on the role of electron beam computed tomography (EBCT) may seem out of place in such a practically oriented volume. Its place becomes more evident, however, when one considers that this exciting new tool provides for the first time a non-invasive means of detecting calcium deposits in the coronary arteries that supply the heart muscle with blood. These calcium deposits are a sure sign that arteriosclerosis is present, thereby constituting an important early warning sign of increased risk of developing coronary heart disease. It is particularly interesting, therefore, that in a recently published study of over 300 healthy men and women aged 18-30 (*JAMA*, May 17, 2000, pp. 2546-2551), those with high hostility scores

were *two to three times* more likely to have coronary artery calcifications than their more easy-going, less angry counterparts.

This study shows for the first time in a group of healthy young adults that a high level of hostility and anger is associated with the early signs of arteriosclerosis. At the same time we know that preventative steps to improve physical, psychological, and spiritual fitness—also covered in this book—have the potential to stop the ongoing processes that lead ultimately to heart disease and early death. There has already been one randomized clinical trial showing that hostility control training in patients who have had a heart attack reduces not only hostility and blood pressure, but also the rate of hospitalizations over the ensuing six months. It seems quite likely that the application of the advice offered in this book on exercise, nutrition, sleep, and anger management will have an even greater impact on preventing the development of heart disease in the first place.

In addition to helping senior military leaders—and indeed senior leaders from any profession or walk of life—cope more effectively with the stresses they face in the modern world and improve their own health, the information in this book can also help senior leaders perform in ways that make the lives of those under their command easier as well. A senior naval officer told me recently that it costs the Navy over \$40,000 to replace each of the 5,000-plus enlisted personnel who leave the service annually owing to substance abuse, obesity, and other stress-related problems. If senior leaders can themselves be trained in those emotional and behavioral coping skills needed to negotiate the more difficult terrain in today's military environments and enable them to stay the course, might it not also be the case that their improved coping will make the enlisted environment more survivable as well?

In conclusion, this is a book whose time is now. The lessons it teaches can help make senior leaders in the military—not to mention other stressful fields like medicine and business—more effective in managing the new environmental stressors that face them. And if such lessons are taken to heart, both literally and figuratively, senior leaders, the armed forces, and our country will be all the better for it.

REDFORD B. WILLIAMS, M.D.  
Professor of Medicine, Psychology,  
Psychiatry and Behavioral Sciences,  
Director, Behavioral Medicine Research  
Center, Duke University,  
Durham, North Carolina

## CHAPTER 1

# THE U.S. ARMY WAR COLLEGE AND THE ROAD TO EXECUTIVE HEALTH AND FITNESS

John Duncan, Mark A. Vaitkus, and William F. Barko

## INTRODUCTION

The pace of an executive's day can match the speed of the information super highway. Many executives rise between 5:00-6:00 a.m., some earlier. Turn on the home computer. Make coffee. Read their e-mail. Read the paper. Shower. Drink java. Hit the road. Commute times often exceed one hour during which time they are frequently tied up in heavy traffic, on the cell phone, using spare minutes to conduct business on the freeway while finishing the rest of their coffee. Arrive at their office. Peruse their e-mail. Answer calls. Attend a series of meetings throughout the day, continuing to down more coffee which may be supplemented by an occasional donut or snack. A light lunch follows—maybe even a quick hot dog with chili or a candy bar for sustenance. Then more afternoon meetings and conferences. Call home—"I'll be late." Grab some snack food and keep moving. Now the drive home—traffic is tied up even at 7:00-8:00 p.m. On some days, after arriving home there are the scheduled children's activities—soccer, gymnastics, or any number of sports or club activities. Executives often eat on the run or in the car, or have a big dinner late at home, usually food high in fat content. The fast food consumed throughout the day is invariably high in fat. Once the action of the day has ceased, they may try to decompress and watch some TV, perhaps one of the many college basketball games on the tube. Before they know it, their heads are rolling asleep in their easy chairs. They head for bed, from where a few hours later, the day starts all over again.

Today's senior leaders and executives face the multiple challenges of achieving effective organizational performance while optimizing their own performance by maintaining peak levels of personal health and fitness. However, the intensity of government and corporate life can be overwhelming. We demand faster access to information, quicker decision cycles, increased productivity, and measurable improvements on our watch, often with an implied if not explicit zero-defects result. We are constantly connected to the work realm by computers, pagers, cell phones, and video conferencing. We become impatient with delays in traffic or the Internet, and even gulp down our food as quickly as possible during mealtime. We may live out of our vans and SUVs, or in airport terminals. We can frequently end up doing business every spare waking moment. We actually hope that someday we can find a way to work faster and yearn for a method to maintain the high pace of life on a continuing basis. Our society is continually obsessed with the superman/superwoman model for living. However, this road is paved with significant hazards.

Over the last 18 years, the U.S. Army War College (USAWC) has developed a model for health and fitness maintenance of its senior leaders. The model is integrated into the college's

year-long curriculum, which itself focuses on the strategic arts of war and peace. This chapter shares the results of our experience with the health maintenance model, including data summaries as well as scientifically based recommendations for maintaining a high level of health and fitness. Drawing on our experience with senior leaders, we will emphasize the importance of self-discipline in managing the daily stressors and demands of an executive life-style. The present book is not a practitioner's guide or a formula for super-performance, but it is constructed on a foundation of proven success and provides serious food for thought for leaders who want to combine healthy living with a busy, active career.

## **STEADY PROGRESS BUT STILL A LONG WAY TO GO**

With the dawn of the 21st century, we continue to create a society full of fantastic conveniences, instant communications, and creature comforts unimagined just a few decades ago. Yet how many of these advances have led to healthier minds and bodies?

Admittedly, vast arrays of new drugs and medical procedures have exploded on the scene. In addition, the World Wide Web has put an almost infinite variety of scientific data and research findings at the fingertips of the average individual. Although the health care delivery system still has some shortcomings and we have no universal health insurance program, Americans arguably have liberal access to the most advanced medical technology in the world. But are we healthier?

Certainly, our standard of living has never been higher. We are richer and living longer than ever before. Good health, however, is more than simple longevity and per capita income. Are we developing and maintaining our bodies and minds to truly enjoy the fruits of all our achievements? We are not simply discussing old age and retirement here, but healthy lifestyles that enable us and our subordinates to be as productive as we can be right now.

For the most part, it is taken for granted that with the right medical intervention we can survive everything from heart disease to cancer. Survival rates have indeed surged upward as our medical system (at a significant price!) helps us become more adept at managing disease. Yet what about preventing disease in the first place? The data show we are doing far less well on that front.

- Despite a 56% decline in the death rate from heart disease since 1950, heart attack rates remain high and are projected to go higher along with other forms of cardiovascular disease.<sup>1</sup>
- Over half of Americans do not exercise regularly, and 25% are completely sedentary, this in spite of the swelling, media-driven sales of exercise equipment, shoes, and gear.<sup>2</sup>
- Obesity is at epidemic proportions—the National Institutes of Health now considers 97 million American adults, or more than one out of three, to be overweight.<sup>3</sup> We are eating more than ever as serving sizes continue to balloon. All-you-can-eat buffets continue to rise in popularity.



- It's not just how much we eat, it's what we eat. Fast food and saturated fats make up a growing proportion of our diets as reflected in the fact that over half of Americans have cholesterol levels above 200.<sup>4</sup>
- Smoking has declined since mid-century, but one out of four people still smokes and rates appear to be rising among young people.<sup>5</sup>
- Stress and its expression in terms of anger, hostility, depression, and violence, both at home and in the workplace, continue to be high. It is estimated that 70% of visits to primary care physicians are related to stress and lifestyle.<sup>6</sup> The biological connection between psychological stress and reduced immune response to infectious disease has been well demonstrated.<sup>7</sup>

Infectious diseases were the leading causes of death in the early 1900s.<sup>8</sup> In early 2000, computers, remote control television, automobiles, and riding lawn mowers are doubtless leading contributors to impaired health and shortened lives. Such labor and time-saving devices have contributed to a life-style of decreased physical activity and increased body weight. The trend toward fatter and less fit individuals is projected to worsen further as the technological improvements converge with an increasing population of older Americans.<sup>9</sup> The health care burden of a sedentary and overweight population could be enormous, threatening the economic stability of the entire health care system.

Physical inactivity and obesity impose both a direct and indirect cost on each person. In economic terms, the medical costs of obesity and physical inactivity together are reported to exceed 94 billion dollars, or 9.4% of national health care expenditures.<sup>10</sup> In human terms, obesity and physical inactivity lead to both a poor quality and quantity of life. The mortality rates for those leading sedentary life-styles are reported to be as much as 60% higher compared to more physically active counterparts.<sup>11</sup> Similarly, mortality rates among the obese are considerably higher than those who maintain an appropriate body weight. Additionally, people who are sedentary and/or obese are admitted to the hospital with greater frequency and are more likely to have frequent pain associated with various chronic diseases, such as arthritis and cardiopulmonary disease.<sup>12</sup>

Any hope for improved prospects for our children is unwarranted. They are on their way to becoming even fatter and more sedentary than we are. Most disturbing is the fact that physical activity or physical education is no longer a part of the curriculum of many elementary and secondary school systems across America. A sedentary and obese life-style could develop into a tragic health situation down the road, since health behaviors adopted early in life are generally maintained throughout adulthood. We are creating a generation of cyberbound health disasters. In fact, research reveals that significant fatty streaks and deposits in the arteries are already detectable by early adolescence in many Americans.<sup>13</sup> As more women enter the work force and America's global economic dominance continues, there are signs that these bad health habits are proliferating both here and abroad.

Most people do not appear ignorant of key disease and health risk factors. We don't seem to need more educational seminars, videos by fitness gurus, and machines and books

emblazoned with the likeness of Suzanne Somers. However, the question remains: why, with all the convincing research results frequently trumpeted by the media, has the impact on the general population been so minimal? Moreover, as indicated above, this trend is affecting the rest of the planet. The World Health Organization reported in 1999 that “heart disease will be the largest single cause of the disease burden globally by 2020.” For the most part, we still have not changed our ways, and these life-style patterns are emerging on a global scale.

The message of this book is that we cannot target these issues at the individual level alone, or hope that some magic pill will solve our health problems. *Actions must occur at the organizational and institutional levels.* Unless good health habits are embedded in one's culture, improvement will take place only on a piecemeal, catch-as-catch-can basis.

## **WHY LEARN FROM ARMY WAR COLLEGE STUDENTS?**

Military students who come to the USAWC are selected for their demonstrated leadership skills and potential for strategic leader positions in the future. They are in their early 40s, are married, with an average of three children, have held some 15 different jobs or assignments, and have served in the military about 20 years. From this group will come the general officers of tomorrow. They are both successful products of the American military culture and highly talented instruments for its shaping. These are the men and women who wrote the final chapters of the Cold War, defeated Iraq in Operation Desert Storm, oversaw the greatest reduction of personnel and unit dismantling since World War II, and continue to perform peacekeeping missions in dozens of hotspots around the globe. By any measure, they have accomplished incredible feats of organizational leadership.

To meet the challenges they have faced in their 20 or more years of military service, these officer students have developed a set of coping strategies that have enabled them to rise to the top while maintaining their physical health, a stable family life, and a grounded sense of emotional and spiritual well-being and purpose. Chief among these strategies is a commitment to fitness and exercise, emphasized and reinforced by the military institution itself. In this book, we will reveal how this group of leaders achieves its superior health and fitness, what they must do to continue along this track even after retirement, and what civilian institutions can do to help ensure similar outcomes. In these pages are the tested and invaluable lessons that every senior leader of the 21st century should know and act upon.

## **THE ARMY PHYSICAL FITNESS RESEARCH INSTITUTE**

In 1982, the Surgeon General of the U.S. Army directed the establishment of the Army Physical Fitness Research Institute (APFRI) on the grounds of the USAWC in Carlisle, Pennsylvania. Its mission was to develop a comprehensive health and fitness program designed to fit the needs of senior middle-aged officers. A key focus was reducing the risk of cardiovascular disease. Over the years, the APFRI staff designed programs for stopping smoking, lowering blood pressure, cutting down on dietary sugar, fat, and cholesterol, managing stress, and improving body flexibility, strength, and aerobic fitness.

Integral to the APFRI program is a comprehensive health and fitness assessment that students are invited to complete. This assessment includes the following elements:

- Aerobic fitness by treadmill testing
- Body strength testing using progressive weights
- Flexibility testing involving full range of motion
- Body composition testing including multiple measures of body fat percentage and distribution
- Blood pressure measurement
- Blood sugar and serum cholesterol testing
- Anger, hostility, and depression surveys

Measurement of coronary artery calcium employing Electron Beam Computed Tomography (EBCT) was added in 1999. This ultrafast heart scan provides actual pictures of calcified plaque buildup in the coronary arteries. Unlike cholesterol, for example, which is a *risk factor* for heart disease, the EBCT provides a *direct indicator* of the early stages of atherosclerosis.

Although certain measurements have been added, changed, or dropped over the years, there now exists a health and fitness database on over 5,000 officers collected since 1982. It is arguably the largest such database compiled on organizational leaders in the world. The data that follow are taken from this 17-year research effort.

## **FITNESS PROFILE OF THE ARMY WAR COLLEGE STUDENT**

Can you learn anything from the data associated with the health and fitness of our students? Are there clues to support a series of recommendations on how to maintain a healthy life-style? We will let you, the reader, be the judge, but the following information should provide a useful snapshot of a healthy and fit senior leader in any case.

In terms of a person at low risk for coronary heart disease, the snapshot would look like this:

- Blood cholesterol 160 to 199 mg/dl
- HDL (good cholesterol)  $\geq$  45 mg/dl in men or  $\geq$  55 in women
- LDL (bad cholesterol)  $<$  130

- Blood pressure < 120 mm Hg systolic and < 80 mm Hg diastolic
- Nonsmoker
- No diabetes mellitus<sup>14</sup>

*Blood Cholesterol Levels.* Abnormal blood cholesterol levels are associated with increased risk for early onset of coronary heart disease. Low-density lipoproteins (LDL or bad cholesterol) are significantly lower in our students than in the typical middle-aged population, while high-density lipoproteins (HDL or good cholesterol) are significantly higher. Our population not only has a significantly higher percentage of healthy individuals, but also a significantly lower percentage of individuals with the highest risk or worst scores.

One could argue that these comparisons are unfair since USAWC males comprise a select

<b>Cholesterol Levels (High Risk)</b>	<b>USAWC Males (40-45) % of Population</b>	<b>U.S. Middle Aged % of Population</b>
Cholesterol (240)	14	About 25
HDL (<35)	9.9	About 20
LDL (>160)	16	About 25

population. However, based on statistical analysis of our data, we are confident that our USAWC students' health profiles are significantly influenced by their life-style and commitment to a regular exercise program. Moreover, USAWC students do not suffer from diabetes. They are screened for this disease during their military careers. Our research suggests that USAWC students probably have less arterial calcification as indicated by the EBCT test than their age group counterparts. Over 70% have a score of zero, or no measurable calcification.

*Smoking.* Smoking remains the number one modifiable risk factor for heart disease, stroke, lung cancer, and a host of other deadly maladies.<sup>15</sup> Smokers have a 70% higher risk for cardiovascular disease than nonsmokers do, and those who smoke two or more packs a day run two to three times the risk.<sup>16</sup> Smoking also compounds the risk associated with other risk factors such as being overweight and having high cholesterol.<sup>17</sup> Even among those who have smoked heavily, however, the risk reduction benefits for quitting are immediate and grow over time.<sup>18</sup>

Despite years of government health warnings, the availability of cessation programs, patches, and gums, the reduction of public places that allow smoking, and even confessions from the cigarette industry concerning its dangers, smoking continues to be a national pastime. The latest figures from the Centers for Disease Control and Prevention show that 22.9% of Americans still smoke regularly, a number that rises to 28% of young people aged

20-24. The costs of smoking in terms of health care expenditures and lost worker productivity are staggering and growing.

Back in the early 1980s, officers at the USAWC looked very much like their civilian counterparts—an average of 30% smoked. Today that figure is less than 4% for men and 0% for women. This steep and steady decline over the last two decades is a testament to the health education effort in the military that was *institutionally reinforced* by the continuous projection of the ideal image of the non-smoking officer—healthy, strong, and successful. Without a military leadership determined to maintain and realize this ideal, it is doubtful whether such a remarkable life-style change could have been achieved, regardless of the individual level of motivation to kick the habit. Education and socioeconomic status also affect this outcome, since smoking rates are still high in the enlisted ranks, but the power of institutionally linking career success and tobacco avoidance, at least informally, should not be underestimated.

*Weight and Body Fat.* Obesity is the second leading cause of preventable death in the United States, and has been linked to such conditions as high blood pressure, diabetes, high cholesterol, gallbladder disease, osteoarthritis, respiratory problems, and breast, prostate, and colon cancers.<sup>19</sup> Its role in many of these conditions also helps account for its association with an increased risk for cardiovascular disease and death.<sup>20</sup>

Unfortunately, the percentage of overweight Americans has gone up substantially since 1980, rising from about 25% to 35% of the population.<sup>21</sup> Although the measure used to calculate these numbers (Body Mass Index or BMI) is the subject of much debate, a recently published study in the *New England Journal of Medicine* that followed more than a million U.S. adults from 1982 to 1996 showed convincingly that those at the upper end of the BMI scale had a substantially higher risk of death from all causes than those in the middle BMI range.<sup>22</sup> The difference was most visible among those who had never smoked and had no prior history of disease.

“Overweight” is defined as having a BMI greater than or equal to 27.8 kg/m<sup>2</sup> for men and 27.3 kg/m<sup>2</sup> for women.<sup>23</sup> By this definition, about 36% of U.S. men and 41% of women in their 40s are overweight; the percentages at the USAWC are 22.5% and 7.2% respectively. Unlike the figures associated with smoking, the BMI numbers have not been declining at the USAWC, and there is some indication they might be rising as in the civilian population. Still, the relatively healthy lifestyle of these officers, especially with respect to aerobic and strength training, which helps reduce body fat, is reflected here, especially for women. The fact that a concerted institutional effort to reduce body weight in accordance with the BMI has not yet occurred (as it did for smoking) probably accounts for the finding that the differences, particularly for men, are not even greater.

The real culprit, at least for heart disease, may be abdominal body fat instead of simple body fat.<sup>24</sup> Thus, in addition to BMI standards, the National Heart, Lung, and Blood Institute emphasizes that waist size should not be over 40 inches for males and 35 inches for females.<sup>25</sup> Based on these criteria, USAWC officers do very well, with less than 2% of men and 4% of women falling over the cutoff. However, with regard to such indicators as waist-to-hip ratio,

which has not been found to be superior to simple waist measurement in predicting disease, and other proposed indicators, standards change depending on the study.<sup>26</sup> But even if we agree with Dr. T. S. Han and his associates that a waist over 37 inches for men and 32 inches for women is a safer cutoff in terms of heart disease risk, the proportions of USAWC officers who require slimming down are still less than 16% and 12% of men and women, respectively.<sup>27</sup>

While there is work to do among USAWC students to reduce weight and abdominal body fat, they definitely have a better starting point than their civilian counterparts. Obesity is due to a relatively high caloric intake that is not matched with appropriate energy expenditure from physical activity. For both groups, the basic prescription is the same—better diet and smaller serving sizes. And even among the fairly fit, more exercise helps.

“Bad genes” is a poor excuse to do nothing. Pima Indians living in Arizona have among the highest prevalence rates of obesity and type II diabetes in the world; yet, Pima Indians living in Mexico have markedly lower body weights and diabetes rates.<sup>28</sup> Similarly, twin studies have reported one twin can be of normal weight while the other twin is obese.<sup>29</sup> These data show it is possible for identical twins to share the same genetic make-up, but to have different body weights. Thus, there is little doubt that diet and physical activity habits can exert a major role in preventing weight-related diseases despite genetic influence.

Recent dietary studies report weight losses as small as 5–10% of body weight often produce the same health benefits as more substantial weight loss.<sup>30</sup> Even a five to ten pound weight loss has been shown to significantly lower resting blood pressure and cholesterol levels.<sup>31</sup> Thus even a very modest weight loss is vastly better than no loss at all.

*Physical Activity.* Many leaders spend 14-16 hours a day meeting an agenda considered important, but they often forget a critical element—their bodies need exercise. We often delay it because “it is not related to the mission at hand.” However, scientific studies continue to demonstrate the importance of regular exercise in sustaining a healthy life-style. The American College of Sports Medicine (ACSM) recommends an exercise program that develops aerobic capacity, flexibility, and strength, as follows:

- Aerobics—20-60 minutes of continuous aerobic exercise on most days. This can be as simple as a brisk walk or a continuous activity in which you break a sweat.
- Flexibility—static stretches with a focus on lower back and thighs, minimum of three times a week. Generally a daily stretching routine is desirable.
- Strength—up to 10 separate exercises that train the major muscle groups; start with one set then progress to two sets of 8–12 repetitions each until the point of fatigue.<sup>32</sup>

The message is clear—“get exercise or die early.” Many best-seller books have been based on a variation of the ACSM model. The Surgeon General’s 1996 report, *Physical Activity and Health*, unequivocally declares that lack of exercise is detrimental to health. The report goes

on to explain, "For optimal health, people of all ages should be physically active on most days because the early onset of heart disease and other medical problems correlates with the lack of physical activity."<sup>33</sup> This simply means the more you exercise, the better your health. Those that get more exercise seem to have a lower incidence of disease and death that flow from heart disease and a number of cancers.

There is sufficient epidemiological evidence to suggest that if sedentary people begin exercising on a regular basis, the risk of developing heart disease will be lowered by approximately 50%.<sup>34</sup> Thus, the question isn't whether regular exercise reduces the risk of heart disease, but the intensity that is required to confer this protective benefit. Research from the 1970s and 1980s suggested that the pathway to good health was vigorous exercise.<sup>35</sup> However, a study published by John Duncan and associates in the early 1990s reported that women who walked 3 miles per day, 5 days a week, at a strolling pace (20-minute miles) achieved health benefits similar to those of women walking the same frequency and distance, but at a more vigorous aerobic pace (12-minute miles).<sup>36</sup> These results suggested for the first time that an increase in intensity may not be required to improve cardiovascular risk. Since then, other studies have reported similar results.

Other recent developments regarding the appropriate exercise prescription focus on the quantity of exercise required. Previous studies associated health benefits with continuous type exercise for the full 30 minutes or more of the workout. Recent data show that intermittent or shorter bouts of activity of at least 10 minutes, with an accumulation of at least 30 minutes or more per day, yield similar health improvements.<sup>37</sup>

In addition, accumulating minutes of exercise throughout the day may be more convenient for some people. Indeed, a recent study has shown better compliance in adopting and maintaining an active way of life among those who accumulated the minutes at their convenience throughout the day.<sup>38</sup> This type of exercise workout plan seems well-suited for those who lack time to exercise 30 minutes or more in a single session.

*Aerobic Exercise.* Results from almost all major scientific studies demonstrate that exercise assumes a role in both the primary and secondary prevention of heart disease, improves mental health, and is associated with a decreased risk of contracting cancer. However, "the slacking off of physical activity is becoming a worldwide phenomenon."<sup>39</sup> The Surgeon General, the American Heart Association, and the American College of Sports Medicine each recently published papers emphasizing the importance of exercise—to cite a few of the many available reports.

At the USAWC we have tested over 5,000 students for aerobic fitness using a maximal stress treadmill test. This test measures aerobic capacity and is nationally normed in such a way that we can compare the aerobic health of the senior military leaders with other middle-aged adults. Regarding aerobic health, our average male USAWC students are between the 80<sup>th</sup> and 85<sup>th</sup> percentiles on the scale encompassing all U.S. males. Numerous studies show a correlation between aerobic fitness on one hand, and lower cholesterol and reduced risk for diabetes and early onset of coronary heart disease on the other—thereby implying a link between aerobic fitness and decreased age-based deaths. The results for our

women are equally significant. Though our sample size consists of only 145 women, their aerobic fitness demonstrates a close match with male profiles. These female leaders are robust and athletic, obviously having adopted a personal health and fitness ethic.

Inherent in the military culture, whether Army, Navy, Marine, or Air Force, is the requirement to pass periodic fitness tests. These tests measure both aerobic fitness (running test) and strength-endurance (at a minimum, sit-ups and push-ups). Military careers depend on maintaining a good level of physical fitness. These criteria alone establish an expectation different from that prevailing in the corporate world. Yet, being “fit to fight” may also provide long-term health benefits. Those early morning physical training sessions may increase the tendency to maintain a lifetime commitment to personal fitness.

Evidence that being more physically active leads to healthier outcomes is simply too persuasive to ignore, yet less than 10% of physicians advise and encourage their patients regarding appropriate dietary or physical activity guidelines. Communities, schools, and other public agencies can play an important role in developing and implementing effective life-style programs, but currently they have a long way to go. Any organization, however, can benefit from incorporating fitness as part of its culture. At this stage in the evolution of American health, it remains counterintuitive to assume that a business will invest a significant percentage of its income on health insurance without making a corresponding investment in the best bargain for health—fitness programs. Indeed, The American Heart Association’s statement on exercise as it relates to employers and community groups recommends such programs.

Employers can make available appropriate space for walking indoors, set aside time during lunch to walk, or offer exercise incentives (financial or cost sharing with employee benefits). Signs can be strategically placed at stairwells encouraging their use and inducements can be extended for employees to park in remote lots and walk to the office. There is increased evidence that work site programs with a comprehensive approach to employee health, including prevention or cessation of smoking, dietary intervention, and exercise, whether on site or nearby (e.g. schools, parks, malls), are not only effective in modifying coronary risk factors but also help reduce absenteeism, accidents, health care costs, hospital admissions, and days of rehabilitation.<sup>40</sup> An investment in a comprehensive fitness program is thus not only an organizational lifesaver but also good business.

*Strength.* In 1991, William Evans and Irwin Rosenberg published *Biomarkers: The 10 Keys to Prolonging Vitality*. In the book, these two Tufts University experts discuss ways to preserve personal vitality and “postpone entry in the disability zone.”<sup>41</sup> Their recommendations emphasize the necessity of regular strength training as part of a personal fitness program. Most of the popular news media stress aerobic fitness—running, biking, swimming, etc.—but Evans and Rosenberg present a convincing argument for middle agers to make strength the prime component of an exercise program. More recently, Dr. Kenneth Cooper, internationally noted expert on health and fitness, reemphasized the importance of strength training in a comprehensive health and fitness program. He also noted the need to increase strength training as one progresses through middle age and into the later years. Controlled research studies demonstrate the importance of continued strength training



through life. It is never too late to start, even for people 80 years and older. The numerous benefits of an integrated strength program will:

- Increase metabolism and therefore burn more calories
- Reduce body fat and increase body leanness
- Increase aerobic capacity, reducing that winded feeling
- Trigger muscles to use more insulin, reducing risk for adult onset of diabetes
- Maintain higher level of HDL (good cholesterol), which is associated with reduced risk for heart disease.<sup>42</sup>

Most importantly, a regular strength training regiment will help reduce the loss of muscle mass as we age. A comprehensive program of aerobic, flexibility, and strength maintenance provides us the opportunity to be as young as we can be for as long as possible. As you age you will need far less assistance in your daily activities than those who lead sedentary lives. It is critical to begin a regular strength program now. It will provide benefits for a lifetime.

USAWC students have shown significant improvements in strength since 1983. As with improvements in reduced smoking habits, the students have increased average strength in almost all years. From 1995 to 1999, the students averaged within the 75-80th percentile of national norms as reported by the American College of Sports Medicine. This means that most male students can lift their weight in a one-repetition maximal lift, while most women can lift over 65% of their weight. Why such excellent performance from middle-age senior leaders whose schedules are as hectic as those of American corporate leaders? We think they have responded positively to recent information on the importance of strength training and integrated it into their personal exercise programs.

That level of commitment may appear intimidating to non-exercisers. For this reason, many people may avoid health clubs or weight rooms. The equipment looks complicated to work with and many of the people who regularly use such facilities appear fitter than the average person. It is important to avoid allowing such perceptions to deter one from adopting a consistent weight-lifting routine. A number of strength-building exercises can be performed in your home that involve little or no equipment. In order to make a difference in your overall health, it is important to design a program that will work specifically for you.

*Stress.* The experience of stress is a normal part of everyday life. In order to adapt to a perceived threat or challenge, the mind and body react by producing adrenaline and cortisol surges, increasing blood pressure, blood flow, and heart and respiration rates. In this manner, humans prepare to deal with the stressor either by fighting or evading it. Some stress, or "good stress," is healthy and enables us to perform at our best when the situation demands it, thus effectively dispatching the stressor. On the other hand, "bad stress" ensues when the stressors become continuous and overwhelming, thus eventually leading to a chronic stress response that can harm the immune system.

In his study of successful aging, Dr. Kenneth Cooper refers to bad stress and its effects as “energy sappers” that drain away youth.<sup>43</sup> Whether due to time pressures, financial problems, health worries, constant travel, family difficulties, or information overload, the effects of this type of stress on the body and mind pose health problems. Cooper reports that chronic stress has been linked with hypertension, high blood sugar, high cholesterol, excessive abdominal fat, and blockages in the carotid arteries, as well as reduction of cancer-fighting cells. Chronic stress may also be reflected through such psychological outcomes as anger, anxiety, and depression. Although scientists stop short of saying that stress actually *causes* heart disease and other illness, its role as a contributing factor continues to be convincing.

Potentially destructive stress appears especially acute on the job. The National Institute for Occupational Safety and Health at the Centers for Disease Control and Prevention says that 40% of workers rate their jobs as “very or extremely stressful.” A 5-year study by the Families and Work Institute shows that 30% of working Americans often or very often feel “burned out” by their jobs. With downsizing and increasing numbers of worldwide missions, the military is hardly immune to workplace stress. Indeed, recent Department of Defense surveys reveal that over 38% of military personnel experience “a great deal” or “fairly large amount” of stress at work.

In contrast, merely 22% of USAWC officers report “sometimes or often” experiencing “too much stress” at work, though admittedly they may well have experienced higher stress levels at their previous assignments. A better indicator of how well they *deal with stress* arises from psychological measures such as the State-Trait Anger Expression Inventory (STAXI), which shows that during most years the percentage of officers falling above the 80<sup>th</sup> percentile on their anger expression scores is below that of the U.S. adult population, that is, between 14% and 17% compared to the national level of 20%.<sup>44</sup> Average anger expression scores have also been lower among USAWC officers compared with civilian adults every year except one. Concerning additional psychological measures of distress, such as the Center for Epidemiological Studies Depression Scale (CESD), our officers also possess lower scores than the general public, with less than 10% reporting symptoms that might indicate a current state of depression.<sup>45</sup> In addition, 92% are “mostly or totally satisfied” with their lives.

There is nothing magical about what helps reduce stress and its deleterious effects. Exercise, social support, and a strong spiritual belief system have been shown in numerous studies to relieve signs of stress, whether they be anger, anxiety, hostility, or depression-related.<sup>46</sup> Our data show similar associations. For example, even though these officers as a whole show a high level of aerobic fitness, those who are *the most fit* are less likely to report being depressed, feeling worried, or having too much work stress and are more likely to report greater life satisfaction.

USAWC officers also benefit from the fact that 94% have someone to turn to when they need support. Most can also rely on their spiritual beliefs and religious group participation to help them cope with life’s stressors. Over 72% say they experience the presence of the Divine or God in their lives, more than two-thirds say their religious beliefs are “what really lie behind my whole approach to life,” and about half are at least weekly churchgoers. Only 6%

never attend church or other religious meetings. Our findings show that the more religious the officer, the less likely that officer is to experience hostility, anger, and depression.

Officers who come to the USAWC are hardly superhumans. In fact, 25% say they never or seldom find time to relax. The good news, however, is that for those who are feeling stressed out, angry, or depressed, there are *institutional* programs available to help, just as there are for improving strength, flexibility, and diet. As we shall see in later chapters, these programs really work.

## **PRIMARY PREVENTION OF HEART DISEASE**

Primary prevention of heart disease involves identifying the persons at high risk for developing heart disease or someone who is likely to suffer a heart attack, or require bypass or angioplasty surgical procedures. Remarkable advancements are now available for the prevention of heart disease. The American Heart Association recently published recommendations for the identification and treatment of individuals at high risk of developing heart disease.<sup>47</sup>

The recommended strategies included blending state-of-the-art imaging modalities to identify high risk individuals for heart disease with new laboratory markers to determine overall risk. Much attention has focused on new laboratory markers of heart disease, including C-reactive protein, plasma homocysteine, lipoprotein (a) [Lp(a)], fibrinogen, and small dense LDL particles. These laboratory markers measured from blood samples provide new and exciting information regarding the potential process involved in the development of heart disease.

The latest data suggest that both genetics and the inflammatory process may play an important role in the development of atherosclerosis.<sup>48</sup> Furthermore, recent studies have shown the ability of these new blood markers to predict future coronary events, adding substantial predictive value to current cholesterol testing alone.<sup>49</sup> Most exciting is the fact that most if not all of these markers can be changed in a healthy direction by diet, vitamin supplementation, physical activity, or currently available medications.

Thus, the American Heart Association recommends first identifying those at high risk with newer imaging modalities, such as Electron Beam Computed Tomography (see Chapter 3). The second step is to measure traditional heart disease risk factors, such as total cholesterol, LDL, HDL, triglycerides, diabetes, smoking, and blood pressure, along with newer heart disease markers from the blood, including Lp(a), homocysteine, fibrinogen, and C-reactive protein. The third step is to evaluate these data to determine risk category.

For those in the moderate to high risk groups, the final step is to develop aggressive preventive strategies, including blood pressure control, cholesterol lowering, smoking cessation, dietary restructuring to lower body weight and intake of saturated fat, initiation of a physical activity program, and selection of appropriate vitamin supplements. The recommendations should be adopted only in consultation with and participation of your

personal physician. Specifically, the risk of developing heart disease may be minimized by following these 12 life-style recommendations:

- Stop smoking.
- Make sure resting blood pressure is normal and controlled (less than 140/90).
- Lower total cholesterol to less than 200 (with weight loss, low fat diet, physical activity, and medication, if necessary).
- Lower LDL cholesterol to less than 100.
- Lower body weight to within 10-15% of appropriate body weight for height.
- Take 400 to 800 mg vitamin E daily.
- Take 500 to 1000 mg vitamin C daily.
- Lower homocysteine levels through increased folate intake and vitamin B6 and B12.
- Get at least 30 minutes of physical activity 5 days per week (start slow with 5-10 minutes of walking and gradually increase duration each week until exercise lasts 30 minutes or more).
- Talk to doctor about taking non-steroidal anti-inflammatory medication if C-reactive protein is elevated.
- Take lipid lowering medication if total cholesterol, LDL, triglycerides, or Lp(a) are elevated.
- For postmenopausal women, talk to doctor about taking estrogen replacements.

At the Army Physical Fitness Research Institute, almost all students volunteer to complete the comprehensive health assessment. After a staff member provides comprehensive feedback of results, many agree to change their habits, begin a new exercise program, and maintain a healthy dietary routine. Despite the idyllic setting of Carlisle Barracks with its excellent facilities, a multi-disciplinary staff, and a supportive culture, however, there are some who do not change. Why? Many excuses for not establishing a consistent program are voiced:

- I do not have time.
- I feel ok, why change?
- It will not affect my bottom line.

- I have other priorities now.
- I know I need to change my lifestyle but I am not ready yet.
- I do not feel comfortable in these modern gym facilities.
- I do not want to look stupid trying to figure out the equipment.

These psychological roadblocks can be overcome with determination and support from family and friends. Too many initiate a diet and/or exercise program only to find themselves back to square one following 3 or more months. Why do people who are informed about the health benefits of regular physical activity and proper diet often fail? The answer may be that they plan to fail rather than fail to plan. For example, many initiate an exercise program at too high an intensity and then succumb to an injury, which derails their entire program. Others may have unreasonable goals and expectations, such as losing 10 or more pounds per week, or getting in shape in 2 weeks. Still others may not consider obstacles in their life-styles, which prevent successful adoption and maintenance of an active way of life. For example, do you overlook time and place opportunities for working out?

Are you a self-starter or do you need a coach or buddy to provide companionship and accountability? The general guidelines listed below may help you in planning and implementing your program:

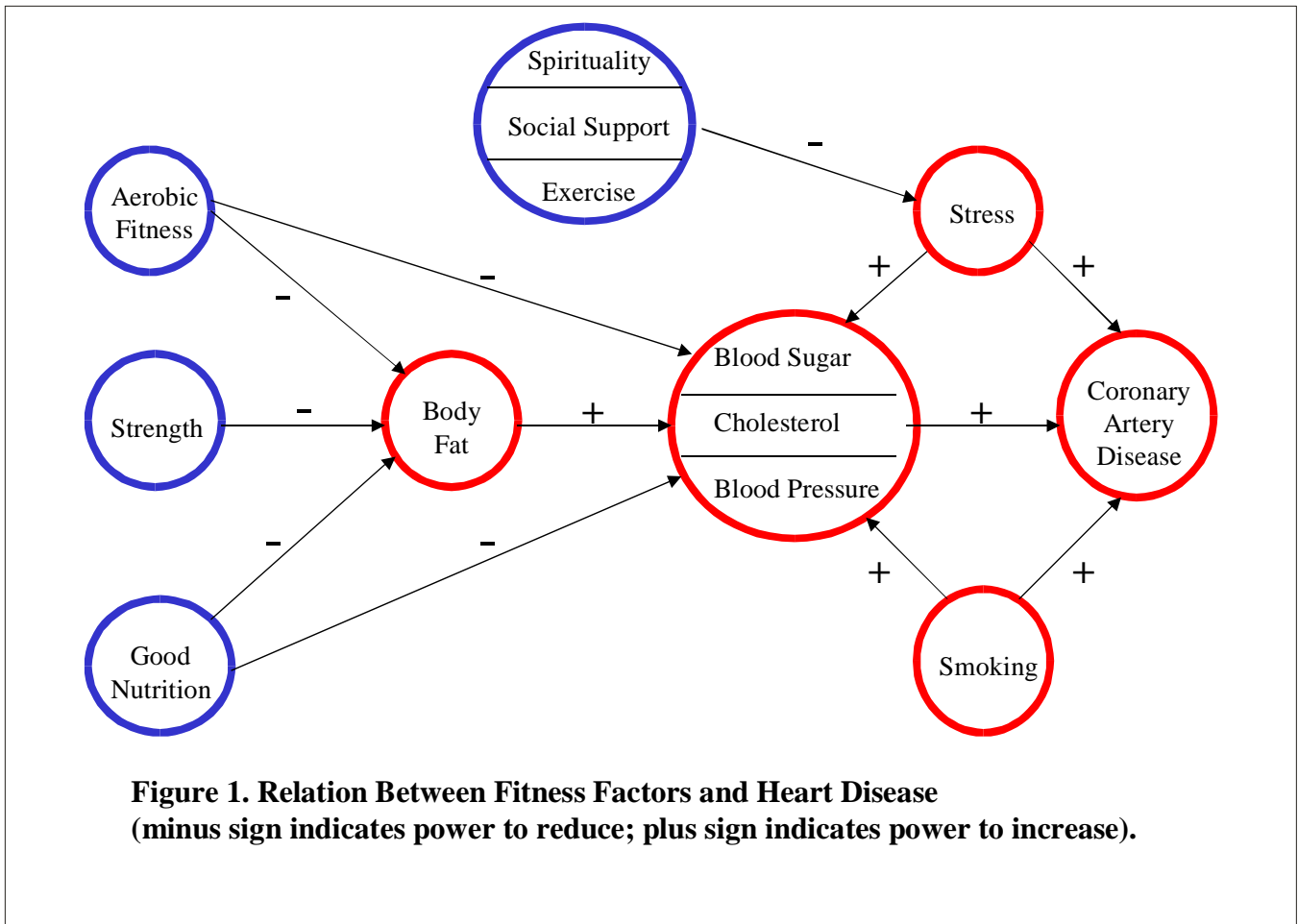
- Write down the reasons why you desire to initiate a physical activity program.
- Find a physical activity you like and feel safe doing.
- Choose an activity you can easily access or incorporate into your daily life-style on a regular basis, an activity which does not require specific clothing, facilities, or excessive time and monetary investments.
- Start slow. Set realistic goals initially. Walk for 5 minutes daily for the first week, then add 2 minutes per week until 30 minutes or two 15-minute routines are achieved; lose half a pound per week while on a calorie-reducing diet.
- Set reasonable long-term goals (i.e. walk for 30 minutes or more; lose 5-10% of bodyweight).
- If you miss a few days, just pick it up again. Do not use a periodic lapse as an excuse to quit or allow other demands of life to distract you.
- Vary or cycle the physical activities you enjoy on a weekly or monthly basis to prevent boredom or staleness.
- Keep daily diet/exercise records.

- Walk every opportunity you can. Take your spouse and children with you. Park your car farther away from your office and take the stairs instead of the elevator.
- Do strength training. It is especially important for your future mobility and quality of life. For example, do more lifting of common household items.
- Find a partner, friend, coach, trainer, or family member to hold you accountable.
- Be a problem solver; analyze the barriers which prevent you from becoming a regular exerciser.
- Buy a dog to take with you on runs; people feel more guilty not exercising Fido than they do not exercising themselves.
- Make physical activity visible in your world; put activity or diet-related information on the refrigerator or place your gym bag at the end of your bed where you can see it in the morning.
- Do not use weather as an excuse. All seasons can provide an enjoyable backdrop for exercise. Simply dress as necessary.
- Reward yourself weekly when you accomplish that week's goal. Go to a movie or out to eat— low fat/calorie, of course!
- Check with your health care provider before implementing a formal program.
- Think Active—Be Active! Recognize the need to balance the use of labor-saving devices and sedentary activities (watching TV, use of the computer) with activities that involve higher levels of physical activity. Walk or bicycle to the local convenience store instead of driving, walk on the walkway in airports instead of using moving sidewalks.

## **PUTTING IT ALL TOGETHER**

Although each of the health and fitness indicators discussed above is important in its own right, they are not independent of one another. Based on our observations and analyses, we propose the model in Figure 1 as a way of understanding how the various components of physical and mental well-being fit together, at least with respect to heart disease. As the model shows, the additive effects of aerobic fitness, strength, good nutrition, social support, and spirituality work to attack the destructive combination of excessive body fat, stress, smoking, cholesterol, high blood pressure and blood sugar, and heart disease.

The model is important because these strong statistical correlations are being found in a group that is generally healthy, disease free, and well above average in physical fitness. Thus, in the general population the payoffs for increasing such behaviors as aerobic and strength training should be even more dramatic.



In this book, we offer the example of a particular population, which, while not perfect, appears to be moving in the desired direction regarding health maintenance. We argue that this group of senior military leaders owes its good health and fitness to a *combination of personal motivation and institutionalized reinforcement*. In addition to improving and maintaining their own health, *these senior leaders have a critical role to play in institutionalizing good health among their workers and followers*. In fact, this role is just as important a responsibility as developing those savvy business habits and effective organizational practices that maximize subordinate morale and productivity.

Our model serves as a partial guideline for the other book chapters. Details related to the importance of a healthy heart, nutrition strategies, coping with life and stress, exercise, and sleep will be discussed. See this book not as a tool used by the authors for profit, but as a guide for you to maintain a high quality of life.

## ENDNOTES

1. See R. A. Hahn, G. W. Heath, and M. H. Chang, "Cardiovascular Disease Risk Factors and Preventive Practices Among Adults—United States, 1994: A Behavioral Risk Factor Atlas," *Morbidity and Mortality Weekly Report* (hereinafter referred to as *MMWR*), December 11, 1998, pp. 35-69. Updated statistics

may be found in the *MMWR* of August 6, 1999. See the American Heart Association's comment on the *MMWR* statistics under *AHA News Releases*, "Figures on Diseases of the Heart Don't Tell the Whole Story," August 6, 1999, at [www.americanheart.org](http://www.americanheart.org). Also see Daniel Levy and Thomas Thom's 1998 editorial, "Death Rates from Coronary Disease—Progress and a Puzzling Paradox," on how heart attack rates have not declined along with mortality rates, in *The New England Journal of Medicine*, Vol. 339, No. 13, 1998, pp. 915-916.

2. U.S. Department of Health and Human Services, *Physical Activity and Health: A Report of the Surgeon General*, Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, 1996, pp. 3-8.

3. National Heart, Lung, and Blood Institute, *Clinical Guidelines on the Identification, Evaluation, and Treatment of Overweight and Obesity in Adults*, Bethesda, MD: National Institutes of Health, 1998.

4. National Center for Health Statistics, *National Health and Nutrition Examination Survey III (NHANES III): 1988-1994*, Hyattsville, MD: NCHS, unpublished data available at [www.cdc.gov/nchswww/data/hvs.pdf](http://www.cdc.gov/nchswww/data/hvs.pdf).

5. Centers for Disease Control and Prevention, "State-Specific Prevalence of Current Cigarette and Cigar Smoking Among Adults—United States, 1998," *MMWR*, November 19, 1999, pp. 1034-1039. Also, H. Wechsler et al., "Increased Levels of Cigarette Use Among College Students," *JAMA*, Vol. 280, No. 19, 1998, pp. 1673-1678.

6. J. L. Boone and J. F. Christensen, "Stress and Disease," in *Behavioral Medicine in Primary Care*, M. Feldman and J. F. Christiansen, eds., Stamford, CT: Appleton and Lange, 1997, pp. 265-276.

7. R. Glaser et al., "Stress-Induced Immunomodulation," *JAMA*, Vol. 281, No. 24, 1999, pp. 2268-2270.

8. "Decline in Deaths from Heart Disease and Stroke United States, 1900-1999," *MMWR*, Vol. 48, 1999, pp. 649-656.

9. K. M. Flegal et al., "Overweight and Obesity in the United States: Prevalence and Trends, 1960-1996," *International Journal of Obesity*, Vol. 22, 1998, pp. 39-47.

10. S. M. Grundy et al., "Physical Activity in the Prevention and Treatment of Obesity and Its Comorbidities," *Medicine and Science in Sports and Exercise*, Vol. 31, 1999, pp. S502-S508.

11. S. N. Blair and S. Brodney, "Effects of Physical Inactivity and Obesity on Morbidity and Mortality: Current Evidence and Research Issues," *Medicine and Science in Sports and Exercise*, Vol. 31, 1999, pp. S646-S662.

12. A. Rissanen and M. Fogelholm, "Physical Activity in Prevention and Treatment of Other Morbid Conditions and Improvements Associated with Obesity: Current Evidence and Research Issues," *Medicine and Science in Sports and Exercise*, Vol. 31, 1999, pp. S635-S645.

13. P. W. F. Wilson and B. F. Culleton, "Epidemiology of Cardiovascular Disease in the United States," *American Journal of Kidney Diseases*, Vol. 32, No. 5, 1998, pp. S56-S65. For a study showing the importance of risk factors such as cholesterol and smoking in predicting artery deposits in those as young as age 15, see H. C. McGill et al., "Effects of Serum Lipoproteins and Smoking on Atherosclerosis in Young Men and Women," *Arteriosclerosis, Thrombosis, and Vascular Biology*, Vol. 17, 1997, pp. 95-106.

14. These categories were derived from the Framingham Heart Study. See P. W. F. Wilson et al., "Prediction of Coronary Heart Disease Using Risk Factor Categories," *Circulation*, Vol. 97, 1998, pp. 1837-1847.

15. See the 1999 report from the Centers for Disease Control and Prevention's Office on Smoking and Health, "Targeting Tobacco Use: The Nation's Leading Cause of Death," available at [www.cdc.gov/tobacco](http://www.cdc.gov/tobacco). Also, see G. Howard, L. E. Wagenknecht, and G.L. Burke, "Cigarette Smoking and Progression of Atherosclerosis,"



*JAMA*, Vol. 279, 1998, pp. 119-124; J. M. McGinnis and W.H. Foege, "Actual Causes of Death in the United States," *JAMA*, Vol. 270, 1993, pp. 2207-2212; and R. Shinton and G. Beevers, "Meta-analysis of Relation between Cigarette Smoking and Stroke," *British Medical Journal*, Vol. 298, 1989, pp. 789-794.

16. See endnote 1.

17. H. C. McGill, "Smoking and the Pathogenesis of Atherosclerosis," in J. N. Diana, ed., *Tobacco Smoking and Atherosclerosis*, New York: Plenum Press, 1990, pp. 9-16.

18. W. B. Kannel and R. B. D'Agostino, "Risk Reduction After Quitting Smoking," *Quality of Life and Cardiovascular Care*, Vol. 1, 1989, pp. 84-85.

19. See endnote 4.

20. W. B. Kannel and P. W. F. Wilson, "An Update on Coronary Risk Factors," *Medical Clinics of North America*, Vol. 79, No. 5, 1995, pp. 951-971. This update relies heavily on data drawn from H. B. Hubert et al., "Obesity As an Independent Risk Factor for Cardiovascular Disease: A 26-Year Follow-up of Participants in the Framingham Heart Study," *Circulation*, Vol. 67, 1983, pp. 968-977.

21. National Center for Health Statistics, *Health in the United States 1996-1997*, Hyattsville, MD: U.S. Public Health Service, 1997, p. 192.

22. E. E. Calle et al., "Body-Mass Index and Mortality in a Prospective Cohort of U.S. Adults," *The New England Journal of Medicine*, Vol. 341, No. 15, 1999, pp. 1097-1105.

23. See R. J. Kuczmarski et al., "Increasing Prevalence of Overweight Among U.S. Adults," *JAMA*, Vol. 272, No. 3, 1994, pp. 205-211; and R. J. Kuczmarski, "Varying Body Mass Index Cutoff Points to Describe Overweight Prevalence Among U.S. Adults," *Obesity Research*, Vol. 5, 1997, pp. 542-548. Some argue that the "overweight" label should be applied to those with BMIs as low as 25.

24. R. F. Gillum, "The Association of Body Fat Distribution with Hypertension, Hypertensive Heart Disease, Coronary Heart Disease, Diabetes, and Cardiovascular Risk Factors in Men and Women Aged 18-79 Years," *Journal of Chronic Diseases*, Vol. 40, 1987, pp. 421-428.

25. See endnote 3.

26. W. C. Willett, W. H. Dietz, and G. A. Colditz, "Guidelines for Healthy Weight," *The New England Journal of Medicine*, Vol. 341, No. 6, 1999, pp. 427-434.

27. T. S. Han et al., "Waist Circumference Action Levels in the Identification of Cardiovascular Risk Factors," *British Medical Journal*, Vol. 311, 1995, pp. 1401-1405.

28. C. S. Fox, J. Exparza, and M. Nicholson, "Is a Low Leptin Concentration, or Low Resting Metabolic Rate, or Both the Expression of the 'Thrifty Genotype'? Results from the Mexican Pima Indians," *American Journal of Clinical Nutrition*, Vol. 68, 1998, pp. 1053-1057.

29. T. Ronnema, M. Koskenvuo, and J. Mamiemi, "Glucose Metabolism in Identical Twins Discordant for Obesity: The Critical Role of Visceral Fat," *Journal of Endocrinological Metabolism*, Vol. 82, 1997, pp. 383-387.

30. P. M. Gordon et al., "The Quantity and Quality of Physical Activity Among Those Trying to Lose Weight," *American Journal of Preventative Medicine*, Vol. 18, 2000, pp. 83-86.

31. Z. X. He, L. J. Appel, and J. Charleston, "Long-term Effects of Weight Loss and Dietary Sodium Reduction on Incidence of Hypertension," *Hypertension*, Vol. 35, 2000, pp. 544-549.

32. *American College of Sports Medicine's Guidelines for Exercise Testing and Prescription*, 5<sup>th</sup> ed., Williams and Wilkins, 1995, pp.162-176.
33. See endnote 2.
34. W. L. Haskell, "Physical Activity, Sport, and Health: Toward the Next Century," *Research Quarterly for Exercise and Sport*, Vol. 67, 1996, pp. S37-S47.
35. K. H. Cooper et al., "Physical Fitness Levels Versus Selected Coronary Risk Factors: A Cross Sectional Study," *JAMA*, Vol. 236, 1976, pp. 166-169.
36. J. J. Duncan, N. F. Gordon, and C. B. Scott, "Walking for Health and Fitness: How Much Is Enough," *Journal of the American Medical Association*, Vol. 266, 1991, pp. 3295-3299.
37. A. L. Dunn et al., "Comparison of a Lifestyle and Structured Interventions to Increase Physical Activity and Cardiorespiratory Fitness: A Randomized Trial," *Journal of the American Medical Association*, Vol. 281, 1999, pp. 327-334.
38. B. H. Marcus et al., "Physical Activity Behavioral Change: Issues in Adoption and Maintenance," *Health Psychology*, Vol. 19, 2000, pp. S32-S41.
39. International Federation of Sports Medicine, *Physical Activity for Health: Joint Position Statement on Public Policy from the International Federation of Sports Medicine and the World Health Organization*, St. Moritz, Switzerland: Federation Internationale Medicine Sportive, February, 1999.
40. *Statement on Exercise: Benefits and Recommendations for Physical Activity Programs for All Americans*. The statement was approved by the American Heart Association Science Advisory and Coordinating Committee on June 20, 1996. It was also published in *Circulation*, Vol. 94, 1996, pp. 857-862.
41. W. Evans and I. H. Rosenberg, *Biomarkers: The 10 Keys to Prolonging Vitality*, New York: Simon and Schuster, 1992, p. 27.
42. Recommendations on strength training were adapted from Evans and Rosenberg (see endnote 41).
43. K. H. Cooper, *Regaining the Power of Youth at Any Age*, Nashville, TN: Thomas Nelson, 1998.
44. C. D. Spielberger, *State-Trait Anger Expression Inventory: Professional Manual*, Odessa, FL: Psychological Assessment Resources, 1996.
45. L. S. Radloff, "The CES-D Scale: A Self-Report Depression Scale for Research in the General Population," *Applied Psychological Measurement*, Vol. 1, 1977, pp. 385-401. See also J. K. Myers and M. M. Weissman, "Use of a Self-Report Symptoms Scale to Detect Depression in a Community Sample," *American Journal of Psychiatry*, Vol. 137, No. 9, 1980, pp. 1081-1084.
46. For example, see K. H. Cooper, *It's Better to Believe*, Nashville, TN: Thomas Nelson, 1995; N. Lin, A. Dean, and W. Ensel, eds., *Social Support, Life Events, and Depression*, Orlando, FL: Academic Press, 1986; H. M. Benson, *Beyond the Relaxation Response*, New York: Times Books, 1984; and National Institute of Mental Health, *Depression Can Break Your Heart*, NIH Publication No. 99-4592, Bethesda, MD: National Institutes of Health, 1999, available at [www.nimh.nih.gov/publicat](http://www.nimh.nih.gov/publicat).
47. S. C. Smith, P. Greenland, and S. M. Grundy, "AHA Conference Proceedings: Prevention Conference V: Beyond Secondary Prevention: Identifying the High Risk Patient for Primary Prevention: Executive Summary," *Circulation*, Vol. 101, 2000, pp. 111-116.

48. D. A. Morrow and P. M. Ridker, "C-Reactive Protein, Inflammation, and Coronary Risk," *Medical Clinics of North America*, Vol. 84, 2000, pp. 149-161.

49. P. M. Ridker, R. J. Glynn, and C. H. Hennekens, "C-Reactive Protein Adds to the Predictive Value of Total and HDL Cholesterol in Determining Risk of First Myocardial Infarction," *Circulation*, Vol. 97, 1998, pp. 2007-2011.

## CHAPTER 2

### SENIOR LEADER PREPARATION FOR MID-LIFE CHALLENGES

Michael W. Parker, Mark A. Vaitkus, Carolyn Aldwin  
Vaughn Call, and William F. Barko

The most successful year of my life was last year . . . a year when my financial net worth declined by 30%. Sounds devastating; however, my mental net worth went up by millions, because I was able to do what I had longed to do: develop new ideas into a business reality and take the time to help others. I helped my mother, age 90, successfully move from her home of 50 years and become happily situated in her new home; helped a dear friend address a dependency problem and successfully quit alcohol; helped my wife's family organize family business matters; spent more time with my wife and almost-grown children; reestablished my involvement with the church and Christian commitment; and reacquainted myself with an old friend and joined with him in a much needed cause. And I had every intention of playing more golf. Unfortunately that did not occur. As an aside, I look at the financial depletion last year as the best investment I have ever made . . . and I expect that it will reap far greater returns than the losses.<sup>1</sup>

The executive quoted above had just removed his name from consideration as the CEO of a major corporation. He had finally taken stock of his life, mustering the courage and resolve to move in a radically new direction—even at the risk of significant financial sacrifice. We cite his case not to commend his particular new direction—an intensely personal choice based upon his unique circumstances—but rather to applaud his decision to pause at mid-life and reevaluate his personal and professional goals. The continued effectiveness of the military and other organizations rests, in many respects, on the ability of senior leaders like this executive to successfully negotiate the developmental tasks of mid-life such as reevaluating goals, renegotiating the balance between career and family, and developing a sense of “generativity” or the desire to contribute to the well-being of the next generation.

In order to enhance the mid-life transition of officers and other senior executives, the Army Physical Fitness Research Institute (APFRI) at the U.S. Army War College (USAWC) provides the skills and information needed to prepare for family-related tasks and continued psychological and physical health. Officers may participate in programs that focus on the developmental tasks and common life events associated with mid-life and problems related to them.

Senior leaders face a unique set of extreme stressors. For example, chief operating officers of major corporations make executive decisions affecting the careers and daily lives of hundreds of men and women and their families. Just consider the workload and personnel impact of a single merger, acquisition, or restructuring. Senior military leaders are often responsible for the 24-hour security of thousands of soldiers under their command and, in combat situations, may issue orders that result in the loss of life. Such stressors can contribute to a sense of isolation among senior leaders and may be linked to negative health outcomes and poor decisionmaking. Even senior leaders who have attended the USAWC,

while generally fit, have shown some variation in health risks, with a significant minority at particular risk for coronary heart disease.<sup>2</sup>

The experience of stress goes with the territory of being a senior leader. The message of this chapter is that we can better deal with this stress and reduce the psychological strain and health problems resulting from it if we take the time to reflect on our lives as a whole and prepare for likely future life events. With the right social support and programs to help, we can prioritize and take control of our lives rather than become victims.

At the USAWC, by utilizing life-event survey data along with follow-up surveys, we can predict with a high degree of probability major life events (e.g. elder care, retirement) that will occur within the next 5 years and identify successful coping strategies for confronting those events. With the identification of these common events and coping strategies, programs have been designed to prepare senior leaders and their families to deal with them, whether the events are inevitable (e.g. retirement) or contingent (e.g. heart attack). By taking likely aging and family events into account, the overall health promotion program has become developmentally sensitive to the real experiences of senior leaders across the life span.

The program is continually refined through survey feedback and new ideas that ensure that physical and psychosocial assessments along with follow-up interventions remain state-of-the-art. In short, these programs help prepare senior leaders for specific developmental tasks often associated with their age, life, and career stages.

The following pages will highlight key findings about the tasks and events commonly experienced by mid-lifers in order to suggest strategies and resources to help senior leaders prepare proactively for the season of mid-life—that is, to help them ask the right questions and make life-enriching and life-enhancing decisions.

## **THE MIDDLE YEARS**

Maintaining general fitness during the course of life is always a challenge, but becomes particularly difficult during the period known as mid-life. Before addressing the major tasks and common events of mid-life, let us dispel some of the misinformation about this season of the human life cycle. First, mid-life has been defined as a time of crisis for men, brought on by realization of their own mortality. For women, the “empty nest” period after children grow up and leave home, as well as the menopausal period following the fertile years, is also commonly thought of as a time of crisis. However, surveys have consistently shown that marital, job, and life satisfaction are typically high in mid-life, suggesting that the crisis hypothesis is probably inaccurate.

Until lately, little hard research has been conducted on mid-lifers. According to the Director of the John D. and Catherine T. MacArthur Foundation Research Network on Successful Mid-life Development, it was as if the mid-life phase had been skipped in favor of early and late phases of human development.<sup>3</sup> Now, noted researchers, in conjunction with APFRI, are beginning to develop and analyze research data about this phase. More and more

we are learning that the “mid-life crisis” and the “empty-nest syndrome” have little basis in fact. Even so, a number of developmental tasks and common life events make it an extremely challenging period. Eldercare, loss of parents, raising and launching teens, increasing work responsibilities, and the gradual erosion of health and vigor are a few of the events that can affect a sense of well-being during mid-life.

One major developmental task is reevaluating the balance between one’s professional and family life. Senior leaders often voice regrets concerning the perceived imbalance between time devoted to family and the time they invest to achieve vocational and financial security. Often when men determine that they have achieved sufficient success in their careers and decide to invest more time with their families, they find that their children are grown and more interested in pursuing independent lives, while their wives, now finished with child-rearing, may be more interested in developing their own careers.<sup>4</sup> Thus, the balance between family and professional commitments may need to be renegotiated at an earlier stage.

Relying upon one’s value system is the key to determining what set of actions is best, whether the developmental task is renegotiating marital relationships, developing new relationships with adolescent and adult children, or taking on more responsibility for parents. Understanding the meaning and importance of these tasks in light of one’s personal value system will help with the decisions regarding how much time and effort to devote to them. These decisions are especially critical since they may take place at a time when promotions and increasing responsibilities at work place greater demands on one’s time, energy, and attention. An examination and reevaluation of one’s value system may also be in order.

Many of the tensions and strains of middle adulthood result largely from difficulties in balancing conflicting and competing roles while navigating predictable as well as unexpected role transitions.<sup>5</sup> These tensions can be extremely traumatic. For example, an Army general, an only child, received a phone call from his mother’s priest informing him that his mother had come close to burning her house down. The priest suspected Alzheimer’s disease. Unanticipated life events like this one can affect performance at work, bring into question staying in the service, test one’s faith, disturb one’s healthy lifestyle, or create friction in relationships at home and work. Although it is impossible to completely prepare senior leaders for unanticipated life events, preliminary research suggests that the proactive development of plans that precede high probability tasks and events can reduce the stress, improve coping, and induce or encourage favorable outcomes.<sup>6</sup>

Before proceeding to our recommendations concerning preparation for the tasks and events that typify mid-life, let us briefly review central concepts, perspectives, and terms.

## **LIFE-COURSE THEORY AND TERMS**

*A life-course framework* emphasizes “the ways in which people’s location in the social system, the historical period in which they live, and their unique personal biography shape

their experience.”<sup>7</sup> This approach makes a strong connection between individual lives and their social-historical context. Life-course theory emerged in the early 1960s out of life-span developmental psychology, life-cycle research, social relations (role) theory, and the social and developmental psychology of aging.<sup>8</sup> A life-course perspective provides a useful framework for understanding the relationships among physical health, psychological well-being, and common life events that senior leaders face with their family and career. It assumes that growth occurs at every period of life and that continuity and change are a part of life. As people make numerous role transitions across time, a life pattern develops, and they experience changes in social status and personal identity as a result of the pathway they follow.<sup>9</sup> That pathway is “a product of multiple histories, each defined by a particular timetable and event sequence—histories of education and work life, marriage and parenthood, residence and civic involvement.”<sup>10</sup>

*A developmental stage* is a period of life dominated by a particular developmental task, which may require changes in perspectives and values and a renegotiation of social relationships. The notion of stages suggests qualitative changes in competence at each phase of development. The mid-life stage integrates the skills and experiences of the preceding life stages into a commitment for the future. Personality features are often tested, challenged, and modified. Generativity—or an effort to preserve the quality of life for future generations—is often expressed in self-sacrificing commitments to career and family.<sup>11</sup>

*Life events* are discrete, identifiable life experiences or changes that require adaptation by the individual because they disrupt an individual’s psychological equilibrium.<sup>12</sup> Such life events as marriage, the birth of a child, or taking a new job may be positive and anticipated. Others may be traumatic and unanticipated like the death of a parent, spouse, or child. Life events are not chronic in nature, though the consequences of one can be long-term. Most events, even the positive ones, are stressful to some degree and demand coping skills, although only negative life events typically have adverse effects on health.<sup>13</sup>

Historically, military families have had to cope with numerous high stress events and transitions, perhaps more than is typical for their civilian counterparts—deployments, family separations, foreign assignments, command, frequent family relocations, and mid-life “retirement.” These may occur while members simultaneously face demanding and often unanticipated life events associated with mid-life.<sup>14</sup> Additionally, family separations related to deployments, training, and tours of duty may well be among the most difficult aspects of military life.<sup>15</sup> The links between life events and health behavior for senior military leaders, however, are not well known, and little information is available on the mitigating effects of health promotion interventions on these factors.<sup>16</sup>

Whether in or out of the military, leaders do not proceed through the life-course alone. Their life-course trajectories and the trajectories of the significant others in their lives are mutually contingent. While support from significant others is essential for healthy coping, overlapping life-course transitions and events may add to senior leader stress. For example, a wife’s desire to return to graduate school to rekindle her own career may conflict with her husband’s need to transfer to accept a promotion. Women may be particularly vulnerable to the demands of parent care and are often forced to make changes in their own life-courses to

accommodate transitions occurring in their parents' life-courses.<sup>17</sup> The protective effects of spousal social support on senior leader health may thus be counterbalanced or diminished by such additional family stressors.

Major turning points in life-course trajectories frequently reflect involuntary role changes that occur due to biological, psychological, social, and historical events beyond the person's control. These major life-course contingencies are quite common. A heart attack or other serious illness, an accident that causes a severe injury, the death of a spouse, company down-sizing, or an economic recession are just a few events that may cause a complete change in a person's life-course trajectory. The military mobilization during Operation Desert Storm, for example, caused family separation, a significant dysfunction in occupational careers, and increased problems in managing family finances, especially for the enlisted population.<sup>18</sup>

The timing of transitions in the life-course can have either positive or negative consequences for a person. When a person has unusually early or late transitions, makes a transition out of sequence from the normative pattern, or stays in a role longer than normatively prescribed, this person may experience negative life-course consequences.<sup>19</sup> For example, those who marry in their teenage years and those who marry over age 35 have the highest rates of marital disruption.<sup>20</sup> In response to this finding, organizational programs and policies could be designed in an age-graded fashion to assist young singles in how to select a mate.

The unique value of life event history data in designing and tailoring the timing of interventions is only beginning to be realized within the Army's leadership school system.<sup>21</sup> In the future, intervention programs will be designed based on data that reveal when officers and enlisted personnel are at greatest risk to start smoking, experience injuries, divorce, encounter financial problems, face particular parenting challenges, etc. The impact of these factors on deployment, performance, health, economic costs, and retention can be assessed as well.

Four developmentally sensitive tasks related to marital intimacy, parenting older teens, eldercare, and emotional health are particularly noteworthy because each represents a high-probability challenge for modern mid-life leaders. We shall discuss each in turn.

## **DEVELOPMENTAL TASK 1: MARITAL INTIMACY**

My wife and I had many challenges during my career. During my middle years, I was so absorbed with my work that I did not see what was happening to my marriage. The years took their toll clandestinely, insidiously, on the quality of our marriage. When I look back, I wish I had taken the time to reestablish my marriage as a priority. Now it is too late.<sup>22</sup>

Retired CEO, 1999

**Questions.** Is your marriage a priority in your life? Are there issues in your marriage that need attention? Has life taken its toll on the quality of your relationship? In preparing for the next season of life, should you make an effort to revitalize your marriage?



The institution of marriage is currently in transition. Men and women are more likely to share in both the breadwinning and childcare tasks, necessitating continual renegotiation, both within the family and within the work force. While senior military marriages still maintain traditional gender-based roles, with men responsible for careers and women responsible for childcare, this is likely to change with the succeeding generations. Further, more women are acceding to senior military roles, and the data clearly indicate that it is quite difficult for them to maintain both marriages and high-level careers. Just as civilian work places have had to accommodate to the new balance between career and families for men and women, so too will the military have to develop new ways of accommodating dual-career couples in order to enhance retention of their best and brightest officers and enlisted personnel. Thus, senior leaders must serve as role models for members of their organizations; and military organizations must establish policies and programs that foster happiness and stability within marriages for both men and women. The varied demands placed on senior leaders can degrade the marital relationship in the absence of continuous nurturing and renegotiation.

One of the major developmental tasks of middle-adult years is the establishment of a vital intimate relationship, especially a commitment to growth, effective communication, and a creative use of conflict.<sup>23</sup> Proper priority should be given to the cultivation of a growing level of intimacy. Marital stability and happiness have been associated with effective parenting, reduced illness, and increased longevity for men.

As a person becomes more dependent upon other people, interlocking life trajectories occur. In particular, as more women pursue professional careers, couples will need to negotiate the effects of their interlocking vocational trajectories. Most of the USAWC attendees are married (97%) and male (95%). Many of their wives have lived sacrificially by subjugating their own career aspirations to those of their husbands. Among USAWC officers, only about 6% are dual career military families, comparing closely with the rate for the Army at large (7%).<sup>24</sup>

A number of male USAWC officers voiced concerns during the assessment process that their wives had sacrificed their own careers to follow and support them in their military careers. Many felt a sense of obligation to support their wives with their careers, and readily acknowledged that their vocational success was due in part to the consistent support and encouragement provided by their wives. Though female leaders make up less than 5% of the USAWC population, they are less likely to marry, and, if married, are more vulnerable to divorce. The reasons for this outcome and what happens to marriages after USAWC attendance represent two areas for future investigation.

Physical separation from family for deployment reasons is a fact of life for most military personnel because their jobs include field exercises, military courses, and unaccompanied tours. Long-term separations are more common for enlisted personnel than officers.<sup>25</sup> Nonetheless, about two-thirds of the officers at the USAWC had experienced at least one long-term separation from their families as the result of a deployment or duty assignment. Sixty percent of males had at least one duty-related separation, while about 25% had three or more separations; 43% of females had at least one separation. These separations can have

negative impacts on families and their ability to adapt to military life.<sup>26</sup> However, within the officer corps, marriages seem quite resilient and may reflect successful coping strategies for adapting to this significant life event.

Once wars and long-term deployments end, lives have to be reconstructed. This reconstruction often involves a significant change in life-course trajectories. Military programs that help prepare couples and families for this high-probability contingency should be systematically initiated, particularly for specialties that have extremely high rates of deployment.

This type of life-course contingency is not present with the same frequency in the civilian work place. National survey data suggest that about 70% of the married, male civilian work force are never away from home overnight because of work-related travel, and half of those who do travel average less than one night a month away from their families.<sup>27</sup> Civilian career tracks that have requirements for travel and associated family separation might benefit from programs that have been developed for military families. Excellent reviews on family support during military deployments and wartime stress and family adaptation provide specific forms of counsel and advice for units and families.<sup>28</sup>

One nationally known researcher on marriage in America suggests that many partners experience marriage as if they were “walking on egg shells” all of the time.<sup>29</sup> They have an inability to relax in the relationship. Rather than being the safe haven that is desired and needed in a rather heartless world, our best friend, our partner for life, becomes just another person with whom we cannot relax.

Researchers have found four distinctive behavior patterns in marriage that silently destroy marital happiness. First, when conflict arises, one or both partners exhibit a pattern of withdrawal. Second, if an important issue is addressed, the discussion quickly escalates to a point where negative exchanges take place that further distance the couple. Third, a pattern of invalidation occurs in which one or both partners negate one another. The people we love most are often the ones toward whom we are the most unloving. Last, partners begin to read into what was said, thereby sensing unwarranted, unintended negative interpretations about themselves. These negative interpretations are powerful and long-lasting in their effects, serving to create further distance in the relationship. On the average,<sup>30</sup> it takes 20 or more positive exchanges to outweigh the impact of one negative remark.

The following deceptively simple suggestions were conceived to enhance intimacy with your mate across the life-course. They are taken from national research and recent surveys of USAWC officers who have been married only once, longer than 15 years, and who describe their marriages as “very happy.” Use them to evaluate the patterns of your own relationship (e.g. the four detriments to marital intimacy discussed above), and pay particular attention to how you resolve conflict:

- Learn to resolve conflict creatively. Accept the fact that conflict is a part of the relationship.

- Set ground rules for the relationship. Preserve time to have fun and to enjoy the relationship. During such periods of play, *avoid ALL discussion of contentious issues*. Instead, use the time to rediscover your spouse as a friend and lover. Attempt to spend time each week away from the children and distractions.
- Set aside time to address difficult issues as well.
- During periods in which difficult issues are faced, agree to certain rules of communication. For example, if the exchange intensifies, agree ahead of time that either partner can call for a time-out. If time-out is called, agree to meet later at an appointed time. Avoid escalation, adopting instead an attitude of being “quick to hear, and slow to speak.”
- In communicating about difficult matters, allow one person to have the floor first. The other must listen. After sharing, the listener must clarify what was heard, and resist the temptation to disagree. The purpose is simply to clarify what was said. Next, the other partner has the floor, and the same clarification principles are followed. Just like the person taking orders at a fast food restaurant, restate what you just heard to insure communication.
- Cultivate a shared core value system. Even if partners do not share a common faith, every effort should be made to allow communication on a spiritual level. For example, the couple could agree to pray together. Even if one partner was a non-believer, he or she could agree to listen while the other prays orally about their concerns. In exchange, the believing partner could respect the non-believing partner’s perspective by not insisting on attendance at strictly religious functions.
- Seek professional help if you are not able to make progress on any of the suggested recommendations. Consider participation in marriage seminars, couples groups, and other approaches that have the goal of enhancing intimacy with your mate.
- Review the information at the following websites: The National Marriage Project, Rutgers University (<http://marriage.rutgers.edu>); MacArthur Foundation Research Network on Successful Mid-life Development (<http://midmac.med.harvard.edu>); Focus on the Family (<http://www.fotf.org>); National Marriage Encounter—which schedules retreats for married couples (<http://www.marriages.org>); and Christian Marriage and Family Home Page (<http://www.geocities.com/Heartland/Plains/8218>).

## **DEVELOPMENTAL TASK 2: PARENTING OLDER TEENS**

I had no idea how much energy was required as a father of two teens. I have never experienced such a challenge. And was I unprepared for the costs of college. When my last child finally graduated from high school, my wife and I were not prepared for the empty house.

AWC officer & parent, 1998

**Questions.** Do you and your mate need to discuss with each other strategies for parenting your adolescent children? Have you been sensitive to their needs? Can the mid-life period be a time of appraisal and renewal in your relationships with your children? Have you prepared adequately for the college years?

Often compounding the stress associated with parent care is the challenge associated with parenting older teenagers. Adolescents may require just as much attention as younger children, and effective communication is necessary to help teens avoid drugs and premature sexual activity. The parent-adolescent conflicts over appropriate behavior have been the perennial subject of advice columns, books, and seminars.<sup>31</sup> Although almost half of the USAWC officers' families have teenagers at home, one fourth of these families also possess one or more young adults (ages 19-23) as dependents. These young family members impose stress on the family unit, as children seek their independence, go to college, or marry. Thus, at the most critical, stressful point in a senior leader's career, he or she must address interlocking family life-course issues.

At each stage of a child's life, the demands on parents change. Unfortunately, many parents do not anticipate the high level of energy required for parenting teens. In fact, adolescents require emotional support and guidance, make new financial demands on their parents, and need help and cooperation in athletics, after-school activities, and social life.

Though the financial challenge of launching teens into college should be addressed much earlier through appropriate means—such as through a mutual fund savings program—some leaders are not prepared to help their teens with the costs of college. The majority of USAWC officers have children who are teens nearing graduation from high school, meaning these officers will soon encounter increased financial strain. Moreover, a significant percentage of officers decide on geographical separation from families for themselves rather than move their teens during their critical high school years. They don't want to disrupt their teens' high school experience, including academics, sports, school programs, and extracurricular activities that may affect a teen's acceptance into college. Either way, the decision to move or not move teens during the high school years is a difficult one.

Parents often find parenting teens to be a trying experience during which their patience and character are severely tested. Cutting back on extraneous responsibilities outside of the home may help preserve time and resources needed by parents in successfully facing this challenge. Generally, the busier the parent and teen, the more the effort that should be devoted to planning. If both parents work or the primary parent is single, the tensions associated with time pressures can generate intense stress, forcing the parents to prioritize among competing demands.

Professional literature suggests that as teens move toward high school graduation and college, parents should allow their teens progressively more freedom to exercise their own judgment, provide support when they fail, and maintain a degree of authority concerning standards and limits on behavior. The success of senior leaders in developing relationships with their emerging adult children may depend upon their capacity to maintain an open, supportive atmosphere in the family. This may be extremely difficult to accomplish when

promotion opportunities necessitate geographical moves that may disrupt support systems, friendships, and established patterns of play, athletic participation, or academic performance. Senior leaders need to take time to address this developmental task, so that they positively influence their teens in the choice of college and career.

In studying the strengths and vulnerabilities of adolescents in military families, researchers emphasize the positive role of a school culture that integrates the adolescent into the activities of the school, thereby reducing the potential negative impact of school transitions.<sup>32</sup> The peer group serves as a bridge between childhood parental dependencies and an identity and connection with wider social networks.<sup>33</sup> A variety of characteristic strengths are often found in children of military parent(s), including a strong sense of responsibility, excellent social skills, loyalty, willingness to take risks, discipline, tolerance, and the ability to handle crises.<sup>34</sup>

Here is a list of recommendations:

- Make your marriage a priority.
- Reinforce the three R's—respect, responsibility, and resourcefulness—with your teens.
- Encourage a balanced life that includes mental, spiritual, and physical development.
- Attend religious activities with your teens.
- Cultivate teen contact with your parents and grandparents.
- If possible, avoid buying your adolescent a car, and don't rush to help your teen secure a driver's license. Develop clear driving guidelines that address the consequences of risky behaviors (e.g. driving and drinking).
- Get good financial advice regarding the costs of college, and begin *investing* (not saving) for the costs of college as early as possible.
- Spend quantity time with your teens. You will never get quality time without a sufficient quantity of time. As a strategy, develop mutual hobbies with your adolescent children.
- Attempt to establish your home as a place where teens feel comfortable. Get to know their friends and their parents.
- Develop levels of consequences for a range of alcohol-and-drug-related behaviors like driving under the influence. Using illicit, hard drugs should carry more severe consequences than the consumption of one beer at a social function. Attempt to identify drug-and-alcohol-free homes where your teens can safely socialize. Enlist

the support of local school(s). Make every effort to insure a drug-and-alcohol-free atmosphere at home for your teens and their friends.

- Cultivate financial responsibility during the high school years or before. Provide a salary rather than an allowance, and teach teens how to save 10%, give 10%, and live on 80% each month using a spending budget. Prior to college, open a checking account and teach the child how to manage the account.
- Begin investing as early as possible to have sufficient funds to cover the costs of marriage for your daughters.
- Resist the temptation to simply secure compliance from your teens. Take time to ask questions. Aim for understanding before implementing consequences.
- Review the following websites: The Opportunity of Adolescence (<http://www.winternet.com>); Focus on the Family (<http://www.fotf.org>); American Academy of Pediatrics (<http://www.aap.org>); Society of Pediatric Psychology (<http://macserv.psy.miami.edu/SPP>); National Institute on Out of School Time (<http://www.wellesley.edu/WCE/CRW/SAC>); AMA-Adolescent Health On-Line (<http://www.ama-assn.org/adolh1th/adolh1th.htm>); American Academy of Child and Adolescent Psychology (<http://psych.med.umich.edu/web/aacap/brochure.htm>); and Ask NOAH About: Mental Health (<http://www.noah.curry.edu/illness/mentalhealth/mental.htm>).

### DEVELOPMENTAL TASK 3: ELDERCARE

I didn't know how to help. Desert Storm was in full force. Our war mission was clearly a priority, and yet I had to find some way to help. Both parents were Army-trained Arabic linguists who were desperately needed in Kuwait. Both parents had trained for this moment. Their country needed their unique skills. Lives of other soldiers could be affected, but the needs of their family were tremendous. If both soldiers were deployed to Kuwait, the life of his frail, dependent mother would be destroyed.<sup>35</sup>

Battalion Commander in Germany, 1996

**Question:** Have you planned and arranged the family resources, and familiarized yourself with the community resources, so that the very best options are available to address current and future parent and eldercare needs of your family?

Eldercare refers to the informal, unpaid care provided to an elderly person who has some degree of physical, mental, emotional, or economic impairment that limits independence and necessitates ongoing assistance of some form. We live in a period that has been called a triumph of survivorship, a time when people are living longer than ever. The necessity of caring for an aging parent can arise without warning, often after the death of the other parent. The stress of bereavement can precipitate physical illness and sometimes emotional,

financial, and cognitive problems as well for elderly widows or widowers. However, planning for these types of eventualities can help prevent some of the more serious problems.

As adult children of aging parents, the majority of officers have clearly entered the time of life in which a major initiative in the area of eldercare is warranted. In addition to career and assignment concerns, officers, particularly senior officers at the USAWC, face eldercare issues that overlap with career transitions. About half the officers still have both parents living and more than 80% have at least one parent still living, not unlike most in mid-life. For more than half the married officers, both their in-laws are still alive and over 80% have at least one in-law still living. Approximately one third of these officers were not satisfied with their parents' plans for care and support during their declining years. These officers are beginning to feel the stress related to potential or impending eldercare.

Interlocking life-course pathways with parents produce additional stress. About 30% of the officers stated that they were worried about the health of their parents. Much of this worry centers on the health of their parents and parents-in-law. Over 35% of the officers in the USAWC rated their parents' health from poor to very poor, while 39% rated the health of their in-laws as poor or worse. About two-thirds of the officers have spoken to their parents about their plans associated with eldercare responsibilities.

Both men and women are typically involved in caring for their parents. Women, however, are more involved in personal care, while men are more likely to provide financial assistance. Nonetheless, female officers and the wives of officers will likely experience more stress than their husbands, particularly given overseas assignments. Limited housing arrangements reduce their options as they try to cope with their parents' failing health. As a result, many officers resort to contributing cash toward their parents' care because other options are not viable.

Research of past USAWC students with experience in eldercare indicates that those meeting the following criteria will likely have less favorable relationships with their elderly parents and encounter increased stress:

- Having previous experience(s) with elder parent illness,
- Having fewer siblings to help with filial responsibilities, and
- Having the toxic anger component of Type A personalities.

This stress results from greater worry about parents and impairments in their own health. Development of a proactive plan has been shown to reduce stress and enhance perceived health.

The needs of elderly relatives can erupt in periodic crises that manifest themselves over several years. For women, some studies suggest that the care-giving norm is 19 years. This means that you can typically expect to be in some form of caregiver role with your elderly parent for about 19 years from the time of first illness until death. These crises can thrust a

senior leader and his or her family into a bureaucratic maze, where they try to make successive care arrangements in a badly fragmented, long-term care system. Rather than reacting to a crisis, mid-life leaders have an opportunity to prepare proactively for the coming challenges. At a minimum, individuals should collect information on resources for the elderly in their parents' community, and know who their primary care physician is. Especially for widowed parents, having at least medical power of attorney would be helpful. Make a list of relevant financial documents such as checking, savings, and investment accounts, as well as information on safe deposit boxes, physicians, and any medigap policies.

The movie *Dad*, starring Jack Lemmon, portrays a common aging parent scenario with many positive outcomes. Watching this movie might increase family awareness of the issues involved. No one needs the additional stress that comes from unanticipated contingencies.

The field of aging demands a multidisciplinary perspective. Eldercare is a complicated undertaking and will require input from a variety of professional disciplines. Senior leaders should begin now to prepare for this developmental task, which also lies ahead for most middle-aged Americans. Your goal is filial maturity. This implies a relationship with your parents in which you relate not as dependent child to parent, nor as parent to your parents, but as adult child who has established a level of friendship and mutual respect in which reciprocity of giving is characteristic.<sup>36</sup> In order to assist you with the developmental task of eldercare, the following suggestions are made:

- Attend voluntary seminars on the subject, even if both of your parents are deceased. In the future, you will have members of your organization who will experience the problem, and you may be one of the best sources of counsel. Additionally, because the problem is systemic, you may want to support training programs that prepare mid-life soldiers and employees for this filial task. Eldercare has been identified as the number one personnel issue for corporations because it affects performance and retention.
- Visit appropriate caregiving web sites and print out available materials and literature. The following represents a partial list of excellent sources: AgeNet, LLC, 644-A West Washington Avenue, Madison, WI 53703, (608)256-4242 (<http://www.agenet.com>); Care-giving (<http://www.caregiving.com>); Eldercare Web (<http://www.eldercare.com>); Department of Defense Caregiver's Guide (<http://carlisle-www.army.mil/U.S.USAWC/carech02.htm>); Elder Care Locator, (800) 677-1116; and Focus on the Family/Focus over 50 (<http://www.fotf.org>).
- Gain some understanding about the legal issues associated with eldercare. At a minimum, secure from your loved one(s) a durable power of attorney with a health care proxy and a living will from a knowledgeable attorney who is competent to advise you about the state statutes where your parents reside. If your elder is hospitalized, the physician of record must address his/her wishes. If not, your elder's desires may not be realized. Review the following sites: Hospice Association of America, 228 7th Street SE, Washington, DC 20003, (202)546-4759



(<http://www.nahc.org/HAA>); and National Senior Citizens' Law Center, 1101 14th Street NW, Suite 400, Washington, DC 20005, (202) 289-6979 (<http://nslc.org>).

- Promote successful aging practices. Help your parent(s) get started in appropriate forms of exercise. For example, Tai Chi is an excellent form of exercise known to reduce the chances for falls. Insure that your loved one has a knowledgeable, sensitive, geriatric-trained primary care physician (family practice or internal medicine), who can serve as a primary point of contact for reviewing medical care (numbers of medicines, risky behaviors, daily living activities, etc.). Read J. W. Rowe and R. L. Kahn's recent text, *Successful Aging* (Random House, 1998). Review the following web sites: <http://www.medmatrix.org/index/asp> and <http://gen.emory.edu/medweb.geriatrics.html>.
- Gain an understanding of important services available nationally and locally: Resources for Senior Citizens (<http://www.bev.net/community/seniors/seniors.html>) and National Association of Area Agencies on Aging, 1112 16th Street NW, Suite 100, Washington, DC 20036, (202) 296-8130 (<http://n4a.org>).
- Consider a family organizational meeting to discuss and to develop a long-range plan that will address most contingencies. Review current health insurance and long-term care insurance resources, housing options, and availability and location of important legal, financial, medical, and insurance documents. Develop a written plan that addresses the following contingency questions: Do you really understand the health status of your elder, and is your elder taking advantage of the many options available to maximize his/her health and independence? What steps has your elder taken to prepare for long-term care, loss of function, death? Are you and your elder informed about the many legal and financial steps that can be taken to protect your elder, and have you taken the appropriate steps in keeping with your elder's preferences? Do you understand the importance of family and friends to the welfare of your elder, and have you taken the steps necessary to help maximize the benefits of consistent, regular contact? Do you understand the services, resources, and housing options available to your elder, and have you taken the necessary steps to maximize their utilization?

## DEVELOPMENTAL TASK 4: EMOTIONAL HEALTH

I did not realize it until it was too late. I treated my family far worse than those who worked for me. I was more intense and angry at home than I was at work. Now my wife and children are estranged from me. I guess my family and friends were afraid to talk with me about my anger for fear that I might blow up again.

Retired General Officer, 1999

**Questions.** Do you have a pattern of anger that affects your familial and vocational relationships? Do you need to enroll voluntarily in a therapeutic intervention like the

USAWC's stress management program? Have you seriously examined the religious faith component of your life?

Life events not only affect our immediate situation when they occur, but also may have long-term consequences for life options and attitudes. However, whether or not life events have long-term consequences depends in large part upon how individuals cope with them. Two of the factors that affect coping with life events are feelings of hostility—a barometer of emotional health—and spirituality.

The results of research at the USAWC underscore the important relationship between life events, measures of current emotional health, and spirituality. The USAWC officers who express higher levels of hostility while attending the course are more likely to have been officers who were involved in intense combat earlier in their career. Though the latter applies to less than 5% of the USAWC population, this linkage between combat and hostility is significant even when other variables are taken into account and may be predictive of post-traumatic stress symptoms. Nonetheless, having a spouse who shares the military experience and can understand the trauma of combat significantly decreases hostility.<sup>37</sup>

Intense combat experiences are not the only life events that appear to induce current feelings of hostility. Some family and personal events known to increase stress may also result in subsequent feelings of hostility. As mentioned before, worries about parents' health and the potential eldercare thereby necessitated increase personal stress and possibly expressions of hostility.

Religion also mitigates feelings of hostility.<sup>38</sup> Officers who reported that religion is very important in their lives describe having lower levels of hostility. Becoming involved in activities that are personally enjoyable also lowers feelings of hostility. Officers who have hobbies that they have maintained for a number of years are also significantly less likely to report current feelings of hostility.

Finally, anyone who goes on a diet or attempts to quit smoking can experience significant change in their lifestyle or considerable disappointment when they are not able to maintain their good intentions. It is interesting to note that having gone on a diet to lose weight or quitting smoking significantly increases an officer's *current* level of hostility, probably due to the inherent difficulty in making the changes and the irritability that can result from perceived deprivation.

The data illustrate the long-term influence of life events on current feelings of well-being. Positive experiences like religion and hobbies, plus negative experiences like intense combat experience, parent care worries, and adverse career experiences explain about 30% of the variation from the norm in current feelings of hostility. Officers with more negative experiences have higher hostility ratings.

A partial list of potentially helpful websites includes: Christian Legal and Counseling Offices (<http://www.hoyweb.com>); Growth Central (<http://growthgroups.com>); Anger Management in Families (<http://www.parentingtoolbox.com/famanager2.html>); Anger

Management for Families (<http://www.helpself.com/control.htm>); and MacArthur Foundation Research Network on Successful Mid-Life Development (<http://midmac.med.harvard.edu>).

## CONCLUSIONS

The objectives of this chapter has been to raise the level of consciousness about the life course and to help senior leaders at mid-life examine some of the high-probability life events and developmental tasks of life. Examining your marriage and your parenting style with teens may be a difficult process. Learning about eldercare will be a challenging, long-term adventure. Addressing personal health care issues like the level of anger you manifest at home and at work will not be easy. Yet, anticipating common life-course events and tasks and making adequate preparations for them reduce stress and enhance personal and family well-being.

It is critical to remember that one can never completely prepare for all the events and tasks of life. One's maturity is revealed in how one responds to life's challenges. Even negative events can have positive outcomes. Over 4 decades of research affirm that at times when the circumstances of existence seem overwhelming, those who have a spiritual component in their lives tend to weather its storms more successfully.<sup>39</sup>

Each senior leader is encouraged to take full advantage of the opportunities that mid-life presents in engendering life that is physically, emotionally, vocationally, and spiritually balanced. As you and your family write your own history, it is to be hoped that your joint choices and decisions help you all to age successfully.

## ENDNOTES

1. Thomas M. McCulley, Letter to M. W. Parker, September 3, 1999.

2. A. Siegman, E. Franco, and William F. Barko, "Lipid Concentrations and Glucose Levels: Relationships with Anger Expression and Physical Fitness," Presentation at the International Congress of Behavioral Medicine, Copenhagen, 1998; G. Mitchell and William F. Barko, "Health Risk and Physical Fitness in Senior Army Leaders," Unpublished paper under review [2000]; D.A. Wright et al., "Physical Fitness and Cardiovascular Disease Risk Factors in Senior Military Leaders," *Military Medicine*, Vol. 159, 1994, pp. 60-63; and L. A. Labbate et al., "Physical Fitness and Perceived Stress Relationships with Coronary Artery Disease Risk Factors," *Psychosomatics*, Vol. 36, 1995, pp. 555-560.

3. O. G. Brim, "Midlife Research," <http://midmac.med.harvard.edu>, 1999, pp. 1-3.

4. D. W. Wright, B. S. Nelson, and K. E. Georgen, "Marital Problems," in P. C. McKenry and S.J. Price, *Families and Change: Coping With Stressful Events*, Thousand Oaks, CA: Sage, 1999, pp. 40-65; and M. W. Parker, V. R. Call, and W. F. Barko, "Soldier and Family Wellness Across the Life Course: A Developing Role for Social Workers," in *Social Work Practice in the Military*, New York: Haworth Press, 1999, pp. 255-271.

5. G. H. Elder, Jr., Linda K. George, and Michael J. Shanahan, "Psychosocial Stress Over the Life Course," *Psychological Stress: Perspectives on Structure, Theory, Life-Course, and Methods*, ed. H. B. Kaplan, Orlando, FL: Academic Press, 1996, pp. 247–292.
6. M.W. Parker, and V. A. Call, "Military families across the life course: A military model," Paper presented at Gerontological Society of America annual meeting, San Francisco, CA., November 21, 1999.
7. E. P. Stoller and R.C. Gibson, *World of Difference: Inequality in the Aging Experience*, 3rd ed., London: Pine Forge Press, 2000, p. 19; and A. M. O'Rand, "Stabilization and the Life-Course," in *Handbook on Aging and the Social Sciences*, eds. R. H. Binstock and L. K. George, New York: Academic Press, 1990, pp. 130–148.
8. G. H. Elder, Jr., "The Life Course and Human Development," in *Child Psychology, Volume 1: Theoretical Models of Human Development*, ed. R. M. Lerner, New York: Wiley, 1997.
9. B. G. Glaser and A. L. Strauss, *Status and Passage*, Chicago: Aldine, 1971.
10. G. H. Elder, Jr., "Family History and the Life Course," *Journal of Family History*, Vol. 2, Part 6, 1977, pp. 279–304.
11. B. M. Newman and P. R. Newman, *Development Through Life: A Psychosocial Approach*, 7th ed., Belmont, CA: Wadsworth, 1999.
12. Newman and Newman.
13. Stoller and Gibson.
14. M. W. Parker, V. R. Call, and W. F. Barko, "Soldier and Family Wellness Across the Life Course."
15. R. Etheridge, *Family Factors Affecting Retention*, Research Report No. 1511, Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences, 1989; K. Coolbaugh and A. Rosenthal, *Family Separations in the Army*, Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences, 1992; M. W. Segal and J. J. Harris, *What We Know About Army Families*, Special Report No. 21, Alexandria, VA: U.S. Army Research Institute for Behavioral and Social Sciences, 1993.
16. P. Gade, "Military Service and the Life-Course Perspective," *Military Psychology*, Vol. 3, 1991, pp. 187–200; G.H. Elder, Jr., E.K. Pavalko, and T.J. Hastings, "Talent, History, and the Fulfillment of Promise," *Psychiatry*, Vol. 54, 1991, pp. 251–267.
17. M. W. Parker and S. Martin, "Eldercare, an Issue That's 'Come of Age' for Military Families," *Military Family Research Digest*, Vol. 2, No. 3, 1996, pp. 9-11.
18. D. B. Bell, "The Impact of Operation Desert Shield/Storm on Army Families: A Summary of Findings to Date," Paper presented at the 53rd Annual Conference of the National Council of Family Relations, 1991.
19. D. P. Hogan and N. M. Astone, "The Transition to Adulthood," *Annual Review of Sociology*, Vol. 12, 1986, pp. 109–130.
20. J. A. Sweet and L. L. Bumpass, *American Families and Households*, New York: Russell Sage Foundation, 1987.
21. M. W. Parker, Vaughn Call, and William F. Barko, "Soldier and Family Wellness Across the Life Course."
22. As quoted in S. Stanley, *Heart of Commitment*, New York: Nelson, 1999.

23. Newman and Newman.
24. Segal and Harris.
25. Coolbaugh and Rosenthal.
26. Segal and Harris.
27. M. W. Parker, Vaughn Call, and William F. Barko, "Soldiers and Families Across the Life Course," Presentation at the Gerontological Society's Annual Meeting, San Francisco, CA, November 21, 1999.
28. J. A. Martin and P. McClure, "The Evolving Changes of Military Family Life," in J. A. Martin, L. N. Rosen, L. R. Sparacino, *The Military Family: A Practical Guide for Human Service Providers*, Westport, CT: Greenwood Publishing Co., 1999, pp. 11-29; D. B. Bell and W. R. Schumm, "Supporting the Families of Army Peacekeepers: What We Learned from Two Recent Deployments," Paper presented at the Fourth Annual Joint Service Family Readiness Matters Workshop, Portland, OR, May 7, 1988; D. B. Durand, "The Role of the Senior Military Wife—Then and Now," in *The Military Family: A Practical Guide for Human Service Providers*, chapter 5.
29. Stanley.
30. Stanley.
31. F. Cline and J. Fay, *Parenting with Love and Logic*, Colorado Springs: Navpress, 1990; Newman and Newman.
32. D. J. Jeffreys and J. D. Leitzal, "The Strengths and Vulnerabilities of Adolescents in Military Families," in *The Military Family: A Practical Guide for Human Service Providers*, chapter 13.
33. Newman and Newman.
34. M. E. Wertsch, *Military Brats: Legacies of Childhood Inside the Fortress*, New York: Harmony Books, 1991.
35. M. W. Parker, "Eldercare: An Issue That's Come of Age for Military Families," Paper presented at U.S. Army, Europe, and Seventh Army Medical Conference, Garmisch, Germany, April 29, 1994; and N. Hooyman and H. A. Kiyak, *Social Gerontology, A Multidisciplinary Perspective*, 5th edition, Needham Heights, MA: Allyn and Bacon, 1999.
36. Newman and Newman.
37. M. W. Parker, V. Call, and William F. Barko, "Soldiers and Families Across the Life Course."
38. M. W. Parker, V. Call, and William F. Barko, "Soldiers and Families Across the Life Course."
39. H. Koenig, *The Healing Power of Faith*, New York: Simon & Schuster, 1999.

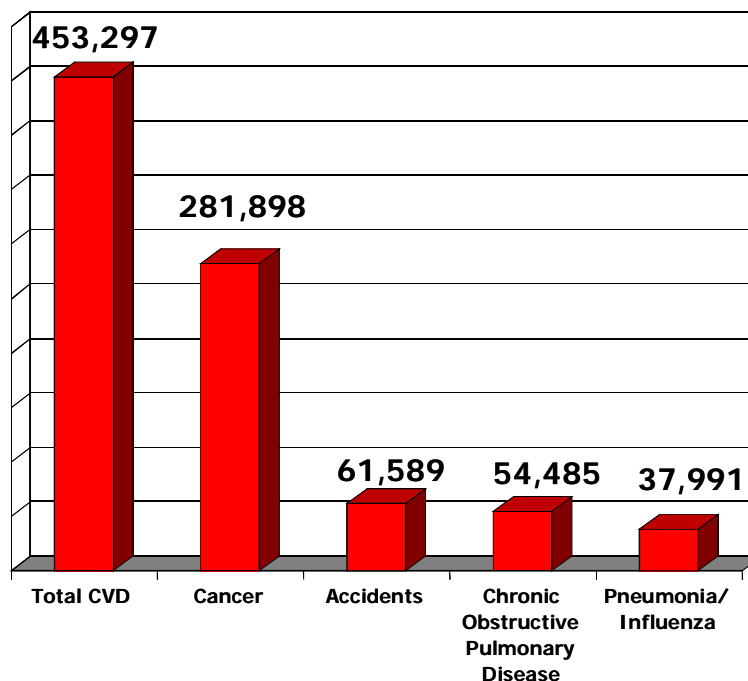
## CHAPTER 3

# CARDIOVASCULAR DISEASE AND THE U.S. ARMY'S ROLE IN COMBATING IT

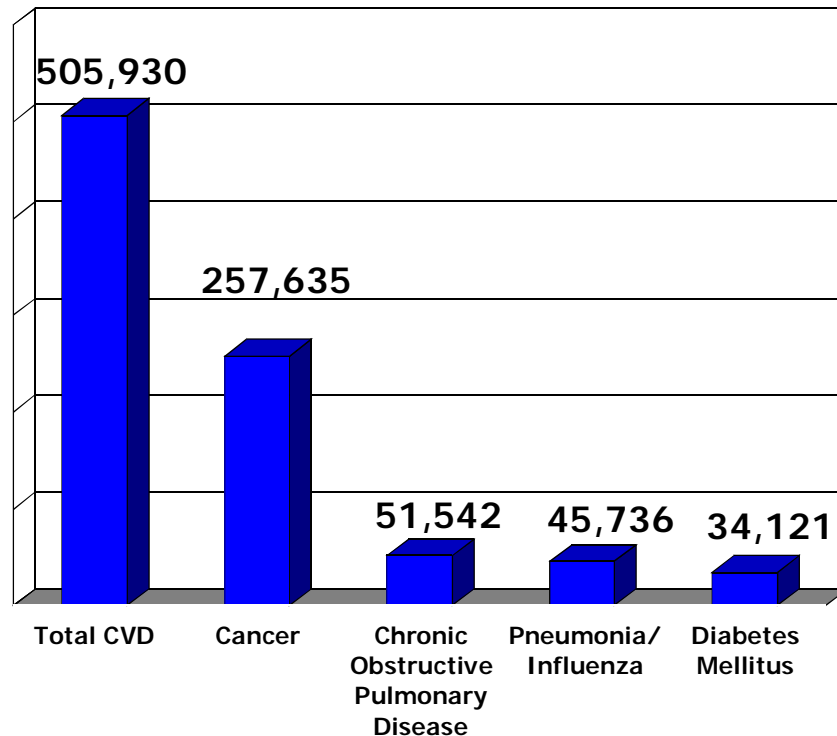
Michael P. Brazaitis, Irwin M. Feuerstein, and Jerel Zoltick

### INTRODUCTION

The 20th century was an era of great technological advancement along with enormous improvement in the quality of life. But there has been a downside. Extensive epidemiological evidence demonstrates that cardiovascular disease (CVD) is increasing in industrialized societies and that its prevalence rose throughout most of the century. Cardiovascular disease remains the leading cause of death in the United States. In 1997 over 450,000 males and 505,000 females died as a result of cardiovascular disease (Tables 1&2).



**Table 1. Causes of Male Deaths in the U.S. (1997)**

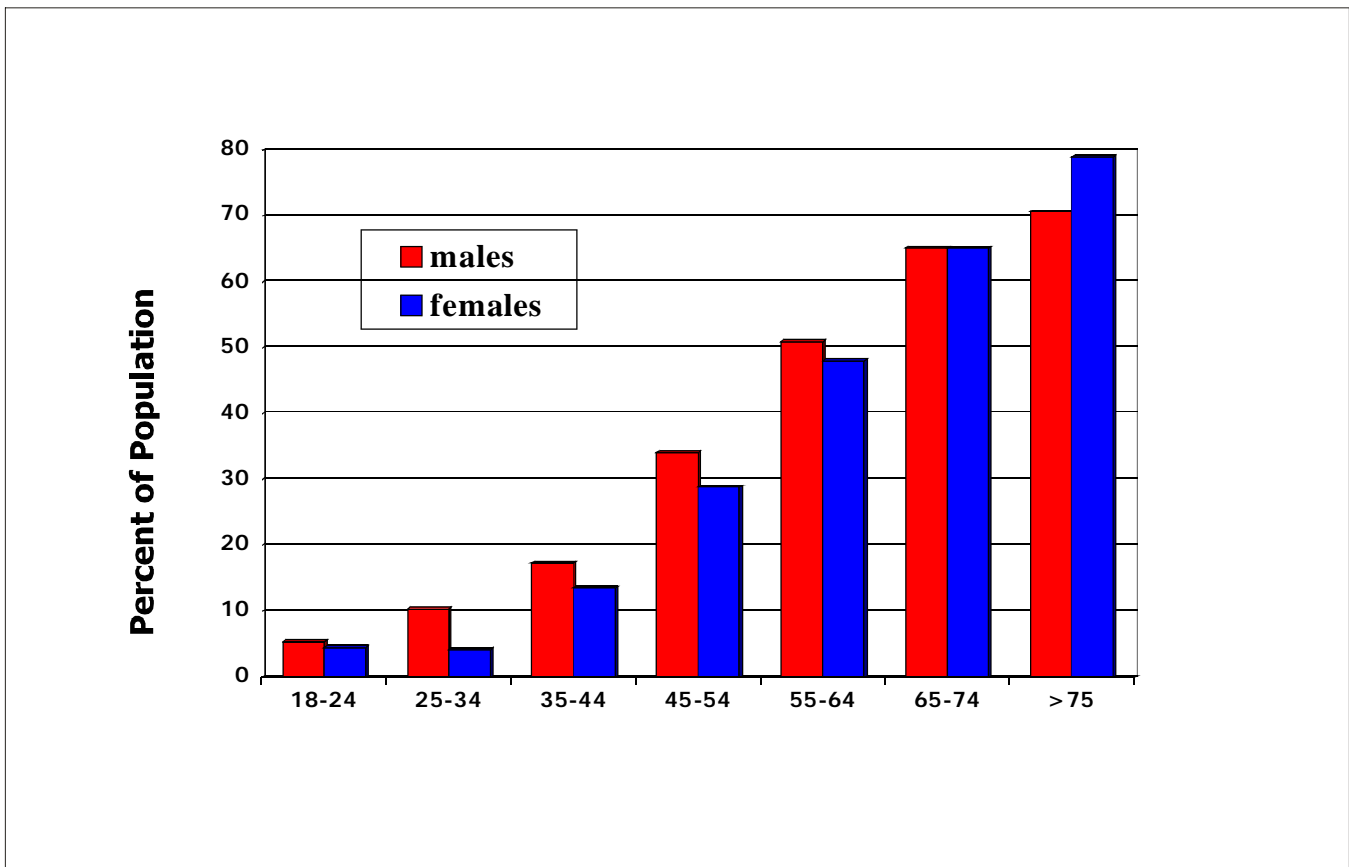


**Table 2. Causes of Female Deaths in the U.S. (1997)**

In all of its manifestations, including stroke, congenital heart disease, and hypertension, CVD accounts for fully 50% of total mortality. The prevalence of heart disease increases for both males and females with advancing age (Table 3). Nevertheless, its occurrence is not insignificant in the younger patient. As reflected by the American Heart Association's statistics, 218,000 males and 74,000 females between 45 and 64 years of age per year will suffer a heart attack (Table 4). Moreover, approximately 1.1 million Americans will suffer a heart attack this year and of this number approximately 500,000 will die. Of additional importance is the fact that approximately one half of those suffering a heart attack have no prior history of heart disease.

During the last 30 years, there has been significant reduction in coronary artery disease mortality, but the extent of the problem is increasing due to the increased life span of the population. CVD, which includes coronary artery and cerebrovascular disease, results in more death, disability, loss of income, and reduced quality of life than all other classes of disease combined. Economically, the disease affects society in both the loss of productivity and the ever-increasing health care costs, now approaching over 100 billion dollars per year.

The reasons for the decline in mortality are not fully understood. Life-style changes, better medical surveillance, and better medical treatment probably account for this trend. Despite the drop in the death rate, the prevalence of CAD is still pandemic. Millions of individuals are now living with CAD and are certainly at risk for congestive heart failure, another heart malady whose incidence is trending upward.

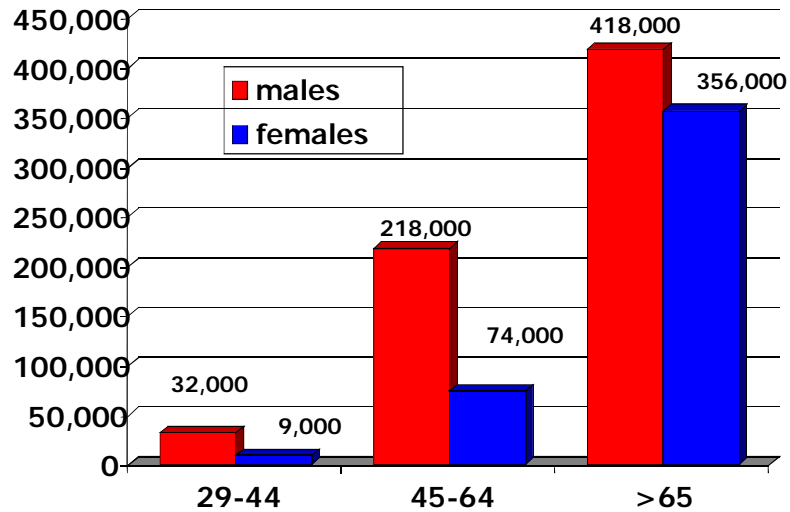


**Table 3. Prevalence of Coronary Heart Disease**

Cardiovascular disease has been described pathologically and clinically since the beginning of recorded medicine. Our understanding of cardiovascular disease is constantly undergoing change. The pathologic abnormalities of the heart and blood vessels of the body have been clearly documented to the cellular level. However, at this juncture we lack a complete understanding of the various disease states and their progression. In many cases, they are described only in speculative and theoretical models. Despite these limitations, our understanding of some of the disease states and their treatment has become highly advanced.

Arteriosclerosis is a generalized term for thickening or hardening of the arteries, which are the vessels supplying oxygenated blood and nutrients to all the tissues and organs of the body. Atherosclerosis is a more specific term applied to the buildup of plaque, which is composed of fatty or lipid-rich material within the internal layers of the medium and large diameter arteries. In the present chapter, we shall be mainly concerned with the more specific term—atherosclerosis—which particularly applies to the coronary arteries.





**Table 4. Projected Annual Heart Attacks**

The mechanism of atherosclerosis starts with an injury on the arterial wall. Circulating blood products, including platelets and fibrin, deposit in the injury. Over time, there is a deposition of fatty molecules, particularly cholesterol. The earliest actual lesion is a fatty streak, believed to be the earliest demonstrable evidence of atherosclerosis. Over time, the fatty streak becomes essentially irreversible. Abnormal proliferation in the number of cells occurs in the internal layers of the affected artery. Eventually, the deposits of fat accumulate and the cells enlarge, which sets up a reaction that causes the lesion to thicken gradually and protrude from the internal layers of the arteries. This process produces organized scarred lesions or plaques. These plaques can enlarge into the lumen (tubular cavity) and partially obstruct the vessel, thus diminishing blood supply to the tissues and organs. Furthermore, blood clots, or thromboses, can form on these atherosclerotic lesions. The local blockage of the blood vessel causes a decrease in blood flow to the heart muscle. This may result in ischemia, the cutoff of oxygen and nutrients flowing to the heart muscle. This transient lack of blood supply to the heart is often accompanied by chest pain (angina). If the blood supply is interrupted for long periods of time, irreversible heart damage may occur through a heart attack.

The characteristic pattern of atherosclerosis is the accumulation of fatty or lipid material in the inner layers of the large and medium sized arteries. There is a predilection for the disease process to occur in the arteries of the heart (coronary arteries), leg and groin (femoral

arteries), and the neck (carotid arteries), as well as in the main artery leaving the heart (aorta). These vessels are most vulnerable to adverse local blood flow and pressure characteristics that tend to promote the disease.

Atherosclerosis is a disease of the young that clinically manifests itself in the middle and later years of life. An American male child has a one-in-five chance of developing clinical heart disease before the age of 65. Random autopsies on young soldiers killed during combat in the Korean and Vietnam conflicts revealed high percentages of early, and in some cases advanced, atherosclerosis—this in a presumed young and healthy population whose average age was 22.<sup>1</sup> Some 10% of the men had already developed severe atherosclerosis in the major coronary arteries (greater than 50% blockage of the artery). These initial landmark autopsy studies give credence to the notion that atherosclerosis begins at an early age. The precise mechanism that initiates and perpetuates the development and progression of the disease process is unknown. The two most commonly suspected culprits—fatty infiltration of blood vessels and arterial wall injury—are in all likelihood closely interrelated.

Atherosclerosis begins when there are certain elevations in various cholesterol components in the blood. Lipoproteins are the main source of cholesterol transport. High-density lipoprotein (HDL) is composed mostly of proteins that have great affinity for transporting cholesterol from tissues to the liver. Low-density lipoprotein (LDL), on the other hand, helps transport cholesterol from the manufacturing site, the liver, to the cell walls of the arteries. HDL thus serves to deter atherosclerosis by binding to the cholesterol and carrying it away from the arterial wall to the liver, where it is broken down and removed from the body. The HDL fragments may also compete with LDL for sites on the arterial wall, thus preventing cholesterol from entering the cells.

In contrast, LDL acts as an enhancer of atherosclerosis. It infiltrates the internal layers of the artery in areas where there had been microscopic wall damage or epithelial injury. Injuries on the vessel wall can be caused by various stresses, such as hypertension or the biochemical effect caused by carbon monoxide from cigarette smoke. Over time, this chronic damage causes degenerative changes within the arterial wall leading to platelet accumulation and smooth muscle proliferation. An interaction can occur between the lipoproteins carried in the blood and the cells lining the arterial wall. Atherosclerotic plaques thereby slowly develop. Plasma-secreting factors, platelets, and other stimuli are responsible for the formation of the clots that have been implicated in all stages of atherosclerosis. Components of the initial clot, formed mostly by platelets, can stimulate cellular proliferation on the arterial wall surfaces.

Our understanding is changing regarding the mechanism of an acute myocardial infarction and possible sudden cardiac death. We know that these untoward events can occur in the presence of non-obstructive atherosclerotic plaques. At a vulnerable site, these plaques can disrupt the thin fibrous cap over an atherosclerotic lesion. This event causes a rapidly occurring cascade of events leading in turn to vessel constriction and acute thrombosis that may result in fatal or non-fatal myocardial infarction. Local inflammation, acute cellular proliferation, and multitudes of mechanisms not yet fully understood are occurring in these dynamic and vulnerable lesions. Certain triggers seem to place these lesions at risk. They

include acute rises in blood pressure and mechanisms that increase clot formation or coagulation (see Chapter 4). Standard coronary risk factors can also act as triggers, as well as complex stress mechanisms including circadian patterns of arousal.<sup>2</sup>

## **THE U.S. ARMY'S INTEREST IN CARDIOVASCULAR DISEASE**

For over half a century, the U.S. Army has been interested in the detection, diagnosis, and treatment of CAD among the active duty and retired populations. These groups have experienced significant physical impairment and death from this disease, thus placing a huge financial and resource burden on the medical system, not to mention the strains imposed by the loss or incapacitation of experienced personnel still in their productive years. As mentioned earlier, on the basis of random autopsies of young soldiers, military pathologists were able to establish that occult coronary atherosclerosis was occurring at very early ages, years before symptoms would have appeared. Ongoing military epidemiological studies have demonstrated the extent of both exercise and non-exercise coronary artery morbidity (disease) and mortality in the active Army population. This CAD death rate has been approximately one per 5,000 in the over-40 Army population, with an ever-increasing incidence in older age groups. Since 1981, the United States Army's Cardiovascular Screening Program has been a part of the physical exam for all soldiers. It has been designed to determine and treat an individual's CAD risk factors and to use non-invasive tests for higher risk sub-groups in order to identify the individuals who are at most risk for cardiac events.

Despite this endeavor, CAD remains the leading cause of morbidity and mortality in the middle-aged soldier. Clinically significant CAD usually manifests initially in post-menopausal women and over-40 men, steadily increasing in both groups thereafter. Likelihood of the disease is further increased by the presence of such risk factors as hypertension, smoking, elevated levels of cholesterol and triglycerides, diabetes mellitus, and family history of the disease.

In order to detect and prevent the progression from occult to symptomatic heart disease, Army physicians have relied on a variety of diagnostic techniques such as treadmill electrocardiography and angiograms. Since the summer of 1997, the Army has incorporated Electron Beam Computed Tomography (EBCT) in an all-encompassing preventive cardiology program called the Walter Reed Army Medical Center Heart-View EBCT. Through extensive medical promotion, the Heart-View EBCT program has become an active and sought-after cardiovascular screening program. This chapter will introduce the concept of EBCT, describe the Heart-View program, and discuss its utility as a key health screening initiative. Epidemiologic and demographic conclusions from the initial study of a patient population are reported, as well as early results of coronary calcium determination. Comparisons with previous literature and other populations are made, conclusions drawn, and recommendations suggested.

## **EVALUATION OF CORONARY ARTERY DISEASE**

When a physician considers evaluating patients for CAD, he or she is immediately confronted with the problem of segregating patients into those demonstrating symptoms such as angina and those who are asymptomatic. The symptomatic patient is evaluated in a relatively straightforward manner. This assessment includes a complete history and physical examination, including an evaluation of the patient's blood pressure, body weight, history of stress, physical activity, and family history. Laboratory parameters include serum cholesterol (both high-density and low-density cholesterol subtypes), triglycerides, fasting serum glucose, a resting electrocardiogram, and likely a treadmill exercise stress test (looking for electrical evidence for impaired blood flow to the heart). Often a patient will also undergo a thallium stress test, employing the injection of a radioactive isotope into the bloodstream and subsequent evaluation of the heart's ability to pump in the face of increasing levels of exercise. Finally, an invasive procedure known as a coronary angiography may be performed. This involves placement of a small catheter and injection of a radiopaque contrast material into the coronary circulation and subsequent imaging of the arteries to look for obstruction or blockage. Also available is a technique called intravascular ultrasound, also invasive, that employs the placement of a small ultrasound-tipped catheter into the coronary circulation for the purposes of measuring the presence of plaque on the interior walls of the arteries. Both of these techniques are expensive, and not without some risk to the patient. These techniques are appropriate for the symptomatic patient, but because of their invasiveness and expense are ill-suited for screening a population of asymptomatic individuals who possess one or more risk factors. EBCT is in a unique position to evaluate the coronary circulation in these particular patients.

EBCT is a simple, non-invasive, rapid scanning device that can provide an accurate quantitative measurement of coronary artery calcification. This information is a valuable component in a comprehensive evaluation of overall cardiac status, complementing the physical examination and other laboratory studies performed by the primary care physician.

### **EBCT: THE THEORY**

Of great importance in the detection of early atherosclerotic changes in coronary circulation is the association of coronary artery calcification with the disease process. Numerous studies have clearly and unequivocally established a direct relationship between coronary artery calcification and the pathologic presence of atherosclerotic heart disease. The volume of coronary artery calcification correlates in a fairly linear relationship with the volume of coronary artery plaque. Additionally, there is a direct association between coronary calcium and both the location and extent of atherosclerotic plaques within the coronary circulatory system. The association between coronary artery calcification and atherosclerotic plaque formation within the coronary vessels has long been a staple of the Army screening program for heart disease, which used cardiac fluoroscopy as a means of detection. As will be shown below, the emergence of EBCT offers superior capabilities in the identification, quantification, and location of coronary plaque disease. This calcium marker

encompasses approximately 20% of all coronary plaque, forming the basis of the EBCT screening method for CAD.

Conventional computed tomography is a primary tool in the diagnostic armamentarium of the radiologist. Over 13,000 of these examinations are performed at Walter Reed Army Medical Center on a yearly basis. Conventional computed tomography uses a focused x-ray beam and a detector array, with both moving around the patient in a circular fashion as the patient moves past the x-ray source and detector array. This process can be time-consuming. Unlike conventional computed tomography, however, EBCT offers the advantage of ultra-fast capabilities.

Although appearing somewhat similar to conventional computed tomography in its outward appearance (see Fig. 1), the inner workings of EBCT essentially involve the generation of a high-speed stream of electrons which are focused on 1-4 target rings situated below the patient. When bombarded by electrons, these target rings generate a highly focused, parallel ray beam of x-rays through approximately a 30-degree arc, which electronically moves through the patient. With the exception of the patient-moving table carrying the patient through the focused field of generated x-rays, there are no moving parts. By combining this process with a triggering mechanism timed to the electrocardiogram, it is possible to get extraordinarily detailed and motion-free images of the heart and the coronary circulation non-invasively and in a matter of seconds. The entire examination is routinely accomplished in less than a minute and requires no sedation or the injection of any material into the patient. Because of its exceptional spatial and temporal resolution and the intrinsic ability of computed tomography to identify regions of varying tissue density (i.e. calcium), EBCT can evaluate with great accuracy the epicardial coronary arteries and the presence of coronary calcification within them (See Figure 2).

## **EBCT: INTERPRETING THE DATA**

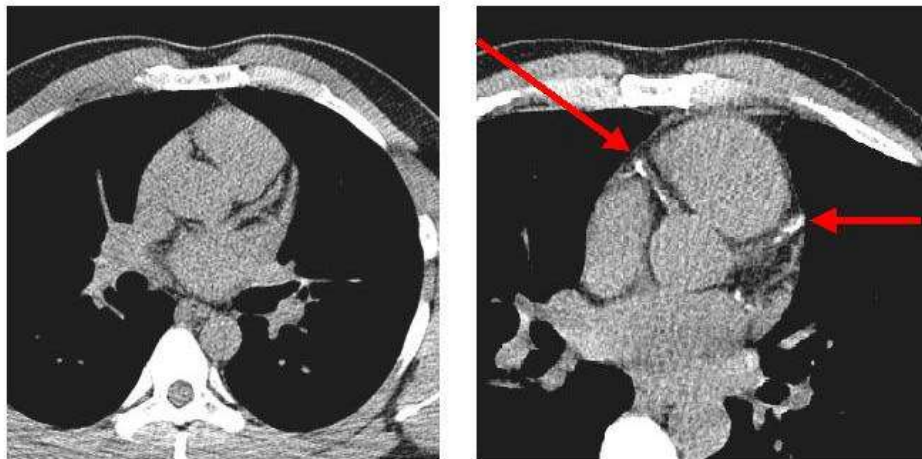
Approximately 15 years ago, A. S. Agatston and colleagues devised a method to quantify the presence of coronary calcification in all of the main epicardial coronary arteries and generate an overall coronary calcium score.<sup>3</sup> This score has been validated in over 19,000 patient examinations and is the technique utilized in the Heart-View Early Diagnosis and Screening Service at Walter Reed Army Medical Center. In considering the performance of EBCT regarding the coronary arteries and the application of the Agatston criteria for coronary calcium scoring, it is important to bear in mind that the presence of coronary artery calcium equals the presence of atherosclerotic coronary artery disease—there are no mimics. The presence of coronary calcification as determined by EBCT equals coronary atherosclerosis. The greater the degree of coronary calcification, the greater the degree of atherosclerotic heart disease present. The technique is both sensitive and specific for the detection of coronary calcification, its extent, and its distribution.

These studies firmly established the prognostic role of the coronary calcium score as determined by the Agatston criteria. Clinical experience has demonstrated that there is a direct correlation between the calcium score in an asymptomatic population and the

subsequent development of symptomatic cardiovascular disease. Recently, three large clinical studies were performed evaluating the prognostic capabilities of coronary screening



**Figure 1. EBCT Scanner Appearance**



**Figure 2. EBCT Results Showing No Coronary Disease (Left) Versus Significant Calcification (Right)**

using the EBCT calcium score. Asymptomatic patients undergoing EBCT were monitored for periods ranging from 19 to 72 months.

For example, R. Detrano and associates evaluated the prognostic value of coronary calcium scoring for predicting coronary heart disease or heart-related events in 491 patients with a mean age of 55 plus or minus 12 years.<sup>4</sup> All of these individuals underwent coronary angiography as well as EBCT. The EBCT coronary calcium scores were divided into quartiles. Odds ratios were calculated for all cardiac events during the follow-up period of 30 months plus or minus 13 months. Those individuals scoring above the 75<sup>th</sup> percentile (i.e. those with high coronary calcium), compared with those scoring below the 25<sup>th</sup> percentile (i.e. those with low calcium) demonstrated an odds ratio of 10.8 with 95% confidence. This means those in the high-calcium quartile were approximately 11 times more likely to have a cardiac event during the follow-up period.

Y. Arad and associates followed 1,173 patients who were asymptomatic at the time of the examination with a mean age of 53 years plus or minus 11 years.<sup>5</sup> After approximately 3.6 years of follow-up, those individuals scoring greater than 160 on their composite calcium score had an odds ratio of developing symptomatic cardiovascular disease of 23 to 1. Agatston and associates followed 367 asymptomatic men and women with a mean age of 52 years for a period of between 36 and 72 months. The odds ratio for the development of asymptomatic coronary artery disease was 6.9 to 1 with 95% confidence for those with an initial calcium score greater than 50, and 2.7 to 1 with 95% confidence for those with a calcium score between 1 and 14.<sup>6</sup> This means that those individuals having the highest calcium scores had a risk of developing coronary heart disease more than 10 times that of those scoring in the lowest quartile.

These and other studies support the concept that coronary artery calcification is correlated with a measurable risk of a definable ischemic cardiac event (i.e. myocardial infarction, heart attack, or occlusion requiring coronary artery bypass surgery) occurring between 19 and 72 months from the time of the examination. Moreover, it was found that the risk of symptomatic cardiovascular disease is proportional to the EBCT total calcium score.

J. A. Rumberger and colleagues recently published a review in the *Mayo Clinic Proceedings* of the literature and guidelines for the use of EBCT and the coronary calcium score in the evaluation of asymptomatic persons.<sup>7</sup> These guidelines divide the calcium scores into five categories. As can be seen from Table 5, a score of 0 indicates the presence of no identifiable calcified atherosclerotic plaque. This shows a very low probability of the presence of significant coronary artery disease in the individual and likewise a very low risk of the near term development of significant or symptomatic CAD. In sum, the EBCT calcium score identifies a relative plaque burden, described as none, minimal, mild, moderate, or extensive—and also indicates the probability of significant CAD being present or developing in the near term.

The guidelines set forth by Rumberger also contain recommendations for patient management, including medical and dietary treatment of elevated cholesterol. These recommendations are based on the National Cholesterol Education Program, Adult

Treatment Panel #2, dealing with the detection, evaluation, and treatment of high blood cholesterol in adults. It should be noted that a negative or extremely low calcium score (i.e.

<b>Calcium score</b>	<b>Diagnosis</b>	<b>Clinical Interpretation</b>
<b>0</b>	No identifiable atherosclerotic plaque. Very low CV risk.	A “negative” examination. Probability >90-95% for absence of “significant” CAD.
<b>1 to 10</b>	Minimal plaque burden. Low CV risk.	“Significant” CAD very unlikely.
<b>11 to 100</b>	Mild, plaque burden. Moderate CV risk.	Likely mild or minimal coronary stenoses.
<b>101 to 400</b>	Moderate plaque burden High CV risk.	Moderate non-obstructive CAD highly likely.
<b>Over 400</b>	Extensive plaque burden Very high CV risk.	High likelihood of at least one “significant” coronary stenosis.

**Table 5. EBCT Calcium Score Interpretation Guidelines**

below a score of 10) does not and cannot totally exclude the presence of coronary atherosclerosis. However, it does establish the absence of fixed or significant obstructive coronary disease with 90-95% confidence.

**EBCT: THE WALTER REED ARMY MEDICAL CENTER EXPERIENCE**

The Department of Radiology at Walter Reed Army Medical Center (WRAMC) instituted the Heart-View Cardiac Screening Program as part of the Early Diagnosis and Screening Service within the Department in 1997. Under the direction of Dr. Irwin Feuerstein, who directed EBCT Research at the National Institutes of Health for over 10 years, the program performed some 6,500 examinations during the first 2 years of its operation. These examinations have been performed on active duty service members, spouses, and retirees. Also, because of its special pediatric applications, a number of examinations have been performed on children as young as 10 weeks of age. The total service provides scanning, evaluation, counseling, and referral by an expert team including computed tomography technologists, nurse counselors, radiologist, and a clinical cardiology consultant. The program has employed the Agatston method of coronary calcium scoring and the Rumberger



guidelines since the program's inception. Approximately 80% of our patients have been male and 20% female, with the percentage of female patients rising with the age category. Approximately 35% of our first 1,000 patients examined were between the ages of 40 and 50 years of age, 43% between 51 and 60, and 12% between 61 and 70. For the most part the health of our population has been somewhat better than the overall health of the general population. For example, only 19% of the patients seen at WRAMC scored in the highest general population quartile for disease and subsequent risk. Only 15% of men less than 45 and 7% of women less than 45 were in the highest quartile for disease. Between the ages of 46 and 50, 24% of men and only 12% of women were in the highest quartile for disease. Between the ages of 51 and 55, 18% of men and 16% of women were in the highest general population quartile for disease.

The screening service is also at the center of a number of clinical investigations involving an analysis of the incidence and prevalence of CAD in the active duty population, the potential evolution of this disease process, and the efficacy of efforts to slow or reverse it. Investigations are also being conducted to evaluate the usefulness of the EBCT calcium score in modifying patient behavior so as to minimize risk factors of coronary heart disease.

A fundamental mission of the military healthcare system is to preserve the fighting strength of the armed forces so that they will be fit enough to win the nation's wars. Performance, deployability, and sustainability are all essential interrelated factors in this equation. The Heart-View Early Diagnosis and Screening Service is involved in every level of this effort.

## **EBCT: ROLE IN THE GENERAL POPULATION**

The ability to diagnose and treat CAD has enormously improved over the last two decades. This improvement has occurred on several fronts. There has been a substantial and far-reaching public health effort directed toward education of patients regarding the signs and symptoms of an acute heart attack, thus prompting earlier medical intervention. Smoking awareness programs and education on the role of diet and exercise in the development of CAD have greatly expanded. For example, the role of pharmacologic intervention in smoking cessation has helped decrease the use of tobacco and tobacco products in some groups. Improved knowledge and awareness of the roles of elevated cholesterol and some elevated blood lipids, as well as familiarity with lipid-lowering drugs (e.g. the statins) have all impacted favorably on the prevalence of coronary heart disease. The role of aspirin both in primary prevention and in decreasing the risk of a second myocardial infarction has been promoted. The acute management of myocardial infarction has also undergone tremendous evolution in the form of pharmacologic clot-busters aimed at relieving the obstruction to blood flow. Thrombolytic therapy has become a major therapeutic advance in the treatment of acute myocardial infarction.

All of these measures have served to improve general prospects for treating acute coronary heart disease. Nonetheless, the disease remains the number one cause of death in the United States. Although most of our active duty force is often regarded as "too young" for the

development of CAD, much evidence supports the supposition that this process is of lifelong duration, beginning in childhood. As is apparent from the figures presented above, CAD often manifests itself in the fifth and even the fourth decade of life. It is thus incumbent upon the organizational health care system to pursue the optimum evaluation and treatment of this disease.

## **WHO SHOULD RECEIVE THE EBCT CARDIAC SCREENING EXAMINATION?**

If you have one or more of the following risk factors for coronary disease, the EBCT examination may be of benefit to you in identifying the potential presence of CAD and determining its relative severity:

- A positive family history for heart attack
- Men over 40 years of age or post-menopausal women
- Smoking history
- Elevated cholesterol
- History of high blood pressure or hypertension
- Overweight by more than 20% of your ideal body weight
- Previous heart attack
- Any existing symptom of cardiac disease, i.e., heaviness or pressure in the chest with exercise, or shortness of breath with minimum exertion such as climbing a flight of stairs.

EBCT can provide important information regarding the relative severity of the disease process as well as its location and distribution within the coronary artery system in a noninvasive way. It can provide valuable information regarding the overall prognostic implications of the patient's condition. It can also serve as a useful tool in helping to determine what patients require more or less vigorous intervention in the form of lipid-lowering medications, the use of aspirin, or other treatment regimens. Electron Beam Computed Tomography can also help to determine which patients would benefit from further diagnostic testing, thallium stress testing, and possibly coronary angiography. Preservation of health and well-being for the soldier and the soldier's family is fundamental to preserving the nation's fighting strength. The early diagnosis of coronary artery disease is essential if this goal is to be realized.

## ENDNOTES

1. W. F. Enos, R. H. Holmes, and J. Beyer, "Coronary Disease Among United States Soldiers Killed in Action in Korea: Preliminary Report," *Journal of the American Medical Association*, Vol. 152, 1953, pp. 1090-1093; and J. J. McNamara, M. A. Molot, and J. F. Stremple, "Coronary Artery Disease in Combat Casualties in Vietnam," *Journal of the American Medical Association*, Vol. 216, 1971, pp. 1185-1187.
2. J. E. Muller et al., "Acute Risk Factors and Vulnerable Plaques: The Lexicon of a New Frontier," *Journal of American College of Cardiology*, Vol. 23, No. 3, 1994, pp. 809–813.
3. A. S. Agatston et al., "Quantification of Coronary Artery Calcium Using Ultra-fast Computed Tomography," *Journal of American College of Cardiology*, Vol. 15, 1990, pp. 823–827.
4. R. Detrano et al., "Prognostic Value of Coronary Calcification and Angiographic Stenoses in Patients Undergoing Coronary Angiography," *Journal of American College of Cardiology*, Vol. 27, 1996 pp. 285–290
5. Y. Arad et al., "Predictive Value of EBCT of the Coronary Arteries: 19-month Follow-up of 1173 Asymptomatic Subjects," *Circulation*, Vol. 93, 1996, pp. 1951-1953.
6. Agatston et al.
7. J. A. Rumberger et al., "Electron Beam Computed Tomographic Coronary Calcium Scanning: A Review and Guidelines for Use in Asymptomatic Persons," *Mayo Clinic Proceedings*, Vol. 74, 1999, pp. 243–252.

## CHAPTER 4

### MENTAL INTENSITY AND YOUR HEART

Jeffrey L. Boone

#### INTRODUCTION

This chapter discusses several concepts integral to the prevention of the early onset of heart disease. With present technological advancement, early detection and primary prevention of cardiovascular disease are possible and even mandatory. The concept of the “Four Horsemen” of mental intensity can provide a better understanding of key disease mechanisms or triggers for a heart attack. Traditional risk factors have been discussed earlier but added to these should be the concept of mental intensity. Through the use of Mental Office Stress Testing, early detection of mental intensity can be provided and serve as a primary prevention initiative.

#### STRESS TRIGGERS FOR HEART PROBLEMS

Firearms lie dormant and seemingly harmless until the trigger sets the firing mechanism into action. However, despite a functional firing mechanism, no one can get hurt as long as the chamber holds no cartridges. In a similar manner, mental intensity can have a triggering effect on cardiovascular health. Hormones associated with mental intensity (i.e. noradrenaline) surge through the bloodstream of a senior executive during stressful times of the workday, acting as potentially lethal “triggers” for cardiovascular events. At age 35, this same executive could adapt to the response caused by noradrenaline because the chamber of the firearm was empty (i.e. cardiovascular risk factors had not been around long enough to make the heart vulnerable). The stress trigger was harmless because it fired in a heart that had not yet been affected by a lifetime of risk factors.

The cardiovascular risk factors of abnormal cholesterol, high blood pressure, diabetes, smoking, obesity, and limited aerobic physical activity act as bullets, waiting for the trigger (i.e. noradrenaline) to set off an acute cardiovascular event such as a heart attack. Later in life, say, at age 55 or older, when the senior executive is confronted with similar tasks demanding high intensity, he is now finally vulnerable to the “loaded” gun. In a sense, he is playing Russian roulette with the susceptible heart. Advanced age, a strong family history of cardiovascular disease, and being of the male gender increase the heart’s vulnerability to the long-term effects of noradrenaline. Logically then, we can conclude that blood pressure, cholesterol, and smoking do not directly kill; they simply establish an environment of increased vulnerability, arming the mechanisms that potentially can result in cardiovascular death.

Noradrenaline, along with other stress chemicals (e.g. cortisol), triggers cardiovascular events (i.e. heart attack or sudden cardiac death) through four separate mechanisms. These mechanisms, referred to as the “four horsemen” of mental intensity, are responsible for laying a foundation that results in adverse cardiovascular events. These mechanisms include:

- Plaque formation and rupture (i.e. coronary atherosclerotic plaque vulnerability)
- Blood clot formation (i.e. coronary thrombosis)
- Electrical abnormality (i.e. cardiac arrhythmia)
- Heart muscle abnormality (i.e. thickness, stiffness, or stretching)

## **THE FOUR HORSEMEN OF MENTAL INTENSITY**

*Plaque Formation.* Coronary atherosclerotic plaque is the most notorious killer of our time. Stimulated by risk factors, the plaque development occurs insidiously over many years, eventually corroding or clogging the arteries that supply blood to the heart. Four major coronary arteries supply the heart muscle with the blood and oxygen necessary for appropriate function. The left main coronary artery (one) branches off the aorta and divides into the left anterior descending coronary artery (two) and the circumflex coronary artery (three). The right coronary artery (four) branches off the aorta on the opposite side to supply blood and oxygen to the right side of the heart. Together, these four arteries provide nourishment to the tireless heart muscle.

Over many years, these arteries can become occluded (blocked, in lay terms) by atherosclerosis—a scar-like sludge of cells, cholesterol, blood clot material, and inflammatory factors. The primary concern with atherosclerosis arises during the later stages of development, when coronary blood vessels can become severely occluded. This occlusion eventually becomes severe enough to restrict blood flow, causing coronary ischemia (i.e. reduced blood flow to the heart muscle) and angina pectoris (i.e. chest pain during exertion). Aggressive medical strategies, using medications and other procedures such as angioplasty or bypass surgery, are often pursued at this point to restore coronary blood flow. These important strategies can be lifesaving since, in addition to controlling angina pectoris by restoring the flow of blood to the heart, they also reverse coronary ischemia. However, managing coronary atherosclerosis during the late stages by focusing primarily on the improvement of coronary artery blood flow does not address the majority of the morbidity (i.e. suffering) and mortality (i.e. death) associated with coronary artery disease.

In the 1990s, research in cardiovascular disease revealed that up to 70% of heart attacks occur in coronary blood vessels only minimally occluded with atherosclerotic plaque.<sup>1</sup> Therefore, it appears that only 30% of heart attacks occur in association with more severe blockages (i.e. greater than 50% occlusion of the vessel lumen or inner diameter). The coronary arteries that are severely occluded often result in angina and abnormal tests (i.e. on

exercise test or electrocardiogram). This paradigm of evaluating atherosclerosis centers around blood flow limitation, while treatment is focused primarily on restoring blood flow.

Amazingly, however, more than two out of three heart attacks occur in association with coronary arteries that are not significantly blocked from a blood flow perspective. These are blockages that do not cause chest pain and do not make treadmill tests abnormal—yet they are very lethal! How can this be? It now appears that blood flow through the coronary artery is only a small part of the medical problem associated with coronary atherosclerosis. In fact, almost all heart attacks are found in association with a coronary plaque disruption (i.e. fracture or rupture of the vulnerable plaque) and coronary thrombosis (i.e. a blood clot adhering to the exposed vulnerable plaque). Therefore, plaque detection and stabilization define a new paradigm for the treatment of atherosclerosis. More and more, the traditional standard of care is being seen as “too little too late.”

Coronary plaque is susceptible to disruption, rupture, or fracture especially in its early stages of development. The “young” coronary artery has a perfectly smooth internal lining conducive to rapid blood flow through the heart arteries with amazingly little shearing stress on the vessel wall. However, over the years plaque develops (often quickly in smokers and those with abnormal cholesterol, high blood pressure, diabetes, abnormal stress response, and poor physical condition), adversely affecting the smooth lining of the coronary artery. The plaque that develops on the innermost lining of the coronary arteries disrupts the integrity of the blood vessel, which then becomes vulnerable to unstable cracks and crevices. At this point, the circular muscles that surround the blood vessel wall lose the ability to relax sufficiently to handle the blood pressure surge in the coronary artery during times of mental and physical stress. Inflammatory cells (i.e. those that cause redness around a cut) weaken the plaque at its junction with the normal areas left in the vessel walls. Liquid cholesterol material lurks under the surface in pockets ready to burst. The progression of atherosclerosis is thus an evolving, percolating, scarring, and growing process. The developing plaque often is unstable and vulnerable to rupture and fracture if triggered by noradrenaline, which further endangers plaque stability during stress by accelerating hemodynamic (i.e. shearing) and vasoconstrictive (i.e. vessel constricting) forces on the coronary artery plaque.

These forces produce minimal effects on the plaque during sleep or times of low stress. However, when the afflicted person awakens and enters the workplace, his or her noradrenaline levels surge, endangering the susceptible plaque with the forces previously described. Not surprisingly, almost nine out of ten heart attacks are associated with plaque disruption. As we have seen, over two-thirds of these occur in blood vessels that are only minimally blocked and that thus fail to generate warning chest pains. Even so, they are exquisitely vulnerable to the “trigger” of stress.

*Blood Clot.* In a deadly progression, the exposed surface of the fractured coronary plaque produces a coronary thrombosis or clot. For centuries, accelerated blood clotting during intense mental stress (e.g. combat) was a lifesaving part of the instinctive fight-or-flight response. Warriors wounded by sword, axe, arrow, or bullet better survived their wounds due to the aggressive clotting stimulated by stress chemicals (i.e. noradrenaline). For example, many of our ancestors survived attack by tomahawk and bear claw because of the clotting

stimulated at the wound to prevent bleeding and promote healing. Our forefathers often survived due to the lifesaving benefits of the surging stress chemicals accompanying the alarm response of conflict.

The senior executive today is rarely confronted with tomahawks or bear claws, but noradrenaline levels still surge as they did in our forefathers. The blood still clots quickly when you are loaded with the noradrenaline of workday accomplishment and challenge. Clotting components activate to make the clot larger and more tenaciously adherent during the intense stress of job strain—a good response if your job is wrestling grizzlies. However, today's wound is not a sword to the flank, but rather a ruptured plaque in a coronary artery. Blood responds today as it did centuries ago with aggressive clotting at the site of plaque rupture and the tenacious clot protecting the wound in the coronary artery wall. Unfortunately, the coronary clot may also occlude the entire blood vessel, thereby blocking blood flow to areas of the heart. If the clot is not eliminated, much of the heart muscle downstream will die as the heart attack spreads. How ironic that the response to mental intensity designed to keep us alive during times of stress is today considered a major health threat in our society!

The clots have moved from the status of protectors to killers during the 20th century. In earlier times, life was filled with physical adventure pulsating with appropriate surges of stress chemicals such as noradrenaline. Today's senior executive is not "tomahawked" or "bear-clawed" in a physical sense. Accelerated thrombotic (i.e. clotting) activity is therefore not needed during the cerebral white-collar stress of the modern era. As a result, the clot becomes a killer, not a "savior." Nearly 90% of all heart attacks occur with coronary plaque fracture (the "new" wound) and coronary thrombosis (the "internal" clot) blocking blood flow to the heart muscle.<sup>2</sup> These processes result from the deadly intersection between the vulnerable plaque disruption, caused by the shear forces and vessel constriction promoted by the noradrenaline of work stress, coupled with the clotting forces of stress working to seal the wound. Unfortunately, instead of promoting healing, the clot clogs the coronary artery. And, to repeat, at least two of three heart attacks that occur in this manner are found in coronary arteries that were only minimally occluded before the plaque fracture (i.e. the kind of lesions that would not be detected with a treadmill test).<sup>3</sup>

*Electrical Abnormality.* The beating of the heart is controlled by cardiac tissue, which is specially adapted to convert chemical signals into electrical impulses that cause the heart muscle to contract in a coordinated fashion. The rhythm of the heart is very sensitive to noradrenaline. In the healthy heart, the pulse quickens during times of physical or mental stress and slows with rest. Usually, if the heart is healthy, the pulse is regular and rhythmic, whether fast or slow. As the heart ages or becomes vulnerable through cardiovascular risk factors, it becomes more susceptible to electrical stimulation by the noradrenaline of stress. A few premature beats generated in the heart atria (i.e. blood receiving chambers) or the ventricles (i.e. blood pumping chambers) each day are often considered normal in an otherwise healthy heart. However, 24-hour EKG monitoring studies show that these premature beats occur in a healthy heart most frequently during the waking hours when noradrenaline levels are highest compared with other times of the day.<sup>4</sup> Similarly, noradrenaline triggers advanced electrical disturbances (arrhythmias), which can be

severely compromising to the heart—especially if the heart is also affected by coronary plaque or cardiac muscular thickness, stiffness, and stretching.

*Heart Muscle Abnormality.* The chambers of the heart work best when they are of normal size. When the chambers enlarge (e.g. left ventricular enlargement and left atrial enlargement) or become thick (e.g. left ventricular hypertrophy) and stiff (e.g. left ventricular diastolic dysfunction), the ability of the heart to pump blood efficiently can be adversely affected. Interestingly, the process of muscular change within the heart arises from many variables, not the least of which is stress-produced noradrenaline. Certainly, heart muscle can thicken in response to pumping against high blood pressure. However, many patients with high blood pressure have no deleterious cardiac muscle changes. In fact, numerous patients who have never had high blood pressure have been found to have dangerous thickening of the heart.<sup>5</sup> Recent data suggest that blood pressure measured during mental stress provides good predictions of abnormal cardiac muscle changes (i.e. thickness, stiffness, and stretching). Blood pressure measured during mental stress also provides the basis for deductions concerning the amount of noradrenaline produced by the subject in generating those blood pressures. Both blood pressure and noradrenaline thicken, stiffen, and stretch the heart over time. Once this occurs, the heart is more susceptible to daily stress. This situation will further complicate any existing coronary atherosclerosis and cardiac arrhythmia conditions.

## **CIRCADIAN RHYTHM OF CARDIOVASCULAR EVENTS**

Each day throughout America, a convenient cycle of noradrenaline production occurs in the population, which helps us understand the impact of stress on the heart. Noradrenaline levels plummet as we sleep and surge as we awaken and enter the workplace. Therefore, the four horsemen of mental intensity should be quiet at night and galloping during the workday (which most Americans experience during the daylight hours). The incidence of heart attacks, stroke, and sudden cardiac death shows that a reproducible pattern occurs each day, with greater numbers of events occurring during the workday and fewer occurring at night. This type of pattern is known as circadian (circa = about; dies = day) rhythm because it happens regularly over a 24-hour period.

In the susceptible patient, the gun is always loaded but the trigger is activated only when noradrenaline “squeezes” the plaque, clot, electricity, and/or heart muscle thus producing the cardiovascular event as its deadly discharge. Countries with the siesta experience a lull in cardiovascular events during those two hours of rest, which serve to relax the trigger finger. In nightshift workers, the noradrenaline pattern is reversed from that of most of the working population. The death rate is accelerated in these workers at night, when the noradrenaline trigger activates upon awakening.

These instances of increased death occur because of the noradrenaline activation of coronary plaque fracture, coronary thrombosis, cardiac arrhythmia, and/or left ventricular diastolic stiffening in the susceptible heart. The famed Framingham Heart Study, which has



monitored several generations of people to determine risk factors and trends in cardiovascular disease, has confirmed this circadian rhythm of cardiovascular events.<sup>6</sup>

## **INTENSITY VS. STRESS IN THE WORKPLACE**

The health implications of stress are very difficult to ascertain with regard to any specific group, business, or individual. Stress generally occurs when the values, beliefs, and goals of the individual do not mesh with the values, beliefs, and goals of the organization. However, preoccupation with such dissonance-induced stress obscures the most critical and ubiquitous effects of stress at work—the cardiovascular and physiological consequences. Therefore, the term “intensity,” which implies the interaction of hard work and noradrenaline, is often preferred over “stress.” For the most part, intensity has an upbeat, positive connotation. When applied to the individual or the corporation, the term intensity seems complimentary, invoking thoughts of pride and accomplishment. At its core, intensity is a good characteristic for the individual worker and for the company. Medical, physiological, and cardiovascular concerns regarding occupational intensity develop only when the demands and pace of job and life accelerate to the point of deleterious physiological effect, or when the age-health-risk profile of the individual worker worsens to the point that previously well tolerated tasks are now of medical concern.

To center the discussion on “stress” evokes negative connotations, often seeming to imply weakness, failure, and burnout. Such perceptions unfortunately permeate corporate culture and may actually interfere with successful stress management from a psychological perspective, whereas the subtle shift toward discussion of intensity issues and susceptibilities takes on positive tones. The focus on intensity can thus be a better starting point, dealing more with heart attack prevention and related medical initiatives than with nervous breakdown issues. Once the program is established with intensity and heart attack prevention as its anchors, more subtle psychological issues can be woven in.

## **CORPORATE INTENSITY VS. INDIVIDUAL INTENSITY**

An individual’s own unique approach to life’s stresses as well as the person’s age, sex, habits, and susceptibilities determine the cardiovascular consequences of mental intensity. Yet, an individual’s environment overlaps the broader universe of family, neighborhood, workplace, and government that further influences cardiovascular health as related to mental intensity. Thus, both individual and corporate responses need to be established to combat the cardiovascular consequences of mental intensity. Fortunately, the same intensity-control strategies that assure the healthy individual also seem to beget the healthy corporation.

Descriptions of the effects of noradrenaline on larger populations are rife in the literature:

- New Yorkers’ death rates from heart attack are 55% higher than the average rates for the United States as a whole.<sup>7</sup> The city’s electric aura stimulates an outpouring of

noradrenaline which triggers a much higher rate of adverse cardiovascular episodes than San Diego, for example. When New Yorkers travel outside the city they die of coronaries at a rate 20% lower than if they had stayed at home. Interestingly, the pace of life in the Big Apple even affects tourists. Their heart attack death rate in New York is 34% higher than the U.S. average for visitors dying outside their home cities. Typically, visitors to other cities among America's ten largest have only about a 1% higher rate of cardiovascular death. The environment of New York is filled with pressure that drives the noradrenaline trigger, causing potentially adverse stimulation of cardiovascular plaque, coronary thrombosis, cardiac arrhythmia, and cardiac muscle. Thus the same heart moving from San Diego to New York finds a new environment of exciting but dangerous noradrenaline and other stress chemicals! Most people love New York just as most executives love their jobs and their corporations. However, healthy awareness of the cardiovascular consequences of exciting, upbeat, and positive intensity is necessary to safely pursue the opportunities offered in life.

- Aerospace workers in the 1960s had an alarming rate of sudden death. In fact, foul play was suspected for a time as the space race with the Soviets heated up. Eventually, it was discovered that the aerospace engineers were literally killing themselves in trying to meet the intense, urgent, and complicated demands of space exploration.<sup>8</sup>
- In Japan, "karoshi" appears on death certificates—meaning "working oneself to death."
- Heart attacks accelerated during the Northridge earthquake and aftermath.
- Sudden death increased as Tel Aviv awaited the missile attacks from Iraq during the Persian Gulf War.
- Most cardiovascular death occurs at work, especially before noon, rather than at home at night, thus illustrating the relatively greater effects on the noradrenaline trigger in a workplace setting.<sup>9</sup>

Recognizing and anticipating mental intensity at the corporate level should stimulate appropriate protective responses. The negative consequences of work site intensity can be proactively mitigated with an emphasis on protective exercise, nutrition, weight control, and stress hygiene/management, coupled with selected screening and prevention strategies.

## **SCREENING ASSESSMENT--MENTAL OFFICE STRESS TESTING**

It is natural for people to arise and tackle the challenges that each day has to offer. The noradrenaline surge prepares us for this task by readying our bodies and minds for action. This is a great part of life and work; yet, it is important to detect when the intensity of work becomes dangerous and worthy of protective attention.

Blood pressure can be a simple, effective marker for stress and intensity susceptibility and sensitivity—but not the usual blood pressure reading you receive in the doctor's office. True,

this is an important reading that defines the disease hypertension (blood pressure readings above 140/90 mm Hg). High blood pressure, even at rest, is an indication that your body has more noradrenaline than it can tolerate.

But the particular blood pressure readings needed for intensity measurement are “stressed-induced.” It is important to perform them on each individual in the corporation. Blood pressures measured during mental stress and intensity are better predictors of the potential harm that can be caused by noradrenaline. Stress-related blood pressure surges predict coronary vessel constriction and shear forces acting on undetected coronary plaques. The magnitude of the blood pressure surge during stress also predicts accelerated blood clotting through noradrenaline-related effects on platelets and other clotting mechanisms. Cardiac electrical instability and cardiac muscular changes are predicted by stress-induced blood pressure surges as well. Blood pressures taken during stress, therefore, begin to identify those susceptible to the four horsemen of mental intensity.

Devices called Ambulatory Blood Pressure Monitors (ABPM) are now available to monitor blood pressure throughout the day. Measurements are taken multiple times every hour and the patient records his or her daily activities in a diary. With this information, the blood pressure response can be correlated with particular stressful activities. However, ABPM is impractical for widespread medical and corporate application because of the large number of persons who require screening. Instead, another simple mental stress testing method can be used for the frequent and widespread screening of persons to establish their susceptibility to the cardiovascular consequences of mental intensity. This testing method is like a mental treadmill that measures the impact of life intensity on the cardiovascular system. I call it the Mental Office Stress Testing Protocol, or M.O.S.T. Protocol. Stressing patients in an office setting produces blood pressure and heart rate responses approximating those experienced by individuals during the more intense times of the workday. The M.O.S.T. Protocol can be performed in less than 5 minutes and is inexpensive in terms of equipment and space. In fact, it could even be performed right at the work station.

The M.O.S.T. Protocol should be used routinely during medical or health screening visits. However, it should be administered more frequently for all individuals who

- are over 40 and male (however, women with blood pressure reactions to intense stress also exhibit increased atherosclerosis<sup>10</sup>),
- have a history of high blood pressure,
- have elevated cholesterol levels,
- have diabetes,
- are smokers,
- are obese,

- live a sedentary lifestyle,
- have a family history of heart disease, stroke, high blood pressure, abnormal cholesterol, and/or diabetes,
- work in high-intensity occupations,
- and/or have specialized risks (i.e. lipoprotein lipase activity, small dense LDL, homocysteine, chlamydia titers, uric acid, etc.).

The M.O.S.T. Protocol, which simulates daily stress and correlates well with ABPM measurements, is performed as follows:<sup>11</sup>

Step 1. Baseline Assessment: Measure sitting blood pressure and heart rate.

Step 2. Relaxation Assessment: Ask patient to relax and breathe deeply and consistently for 5 breaths over 15 seconds. Take blood pressure and heart rate measurements at the conclusion of the final deep breath.

Step 3. Stress Assessment:

- Mathematics challenge—Have patient begin successive verbalized subtraction of 7, starting with 777 (i.e. 777, 770, 763, 756, etc.). Take blood pressure and heart rate measurements after 1 and 3 minutes of subtraction.
- Cold pressor challenge—Insert patient's hand past the wrist in ice water. Take blood pressure and heart rate measurements in opposite arm within 60 seconds.
- Grip challenge—Have patient hold 30% of maximum handgrip. Take blood pressure and heart rate measurements in opposite arm within 60 seconds.

M.O.S.T. Protocol parameters include any blood pressure reading above 160 systolic or 95 diastolic and/or heart rates above 75. Exceeding any of these parameters may indicate increased cardiovascular reactivity to mental stress and designate a potential hot reactor.

Screening with the M.O.S.T. Protocol advances our ability to identify people at risk for intensity-related cardiovascular problems. On the basis of measurements gleaned from the protocol, evaluation strategies for determining the degree of risk can be developed such as those described below, along with health maintenance programs carefully tailored to the condition.

## EVALUATION OF THE MEDICAL CONSEQUENCES OF MENTAL INTENSITY

An abnormal M.O.S.T. Protocol finding, especially when coupled with any other risk factors, requires further medical assessment. An elevated blood pressure surge during brief periods of mental intensity may indicate a problem in one or more of the potentially lethal four horsemen of cardiac concern—plaque, clot, electricity, and muscle.

Optimal noninvasive evaluation strategies can be implemented in patients at highest risk while others determined to have less immediate risk (i.e. those who are younger with fewer compounding problems) can bypass more costly testing and move directly to preventive treatment strategies along with lifestyle modification, adding medication strategies if needed. The noninvasive evaluation strategies are painless, relatively inexpensive, and have an immediate impact in ascertaining how best to manage the cardiovascular consequences of mental intensity. The strategies for each of the four horsemen are as follows:

*Plaque.* An abnormal M.O.S.T. Protocol indicates that the linings of the coronary arteries are being bombarded by noradrenaline during times of intensity. These arteries are then being subjected to vascular narrowing and accelerated shear forces. Simultaneously, factors that promote blood clotting are being stimulated. Remember that two-thirds of all heart attacks occur when non-flow-limiting coronary plaques fracture or rupture. These fractures are then covered with stress-stimulated clotting material, thus occluding the coronary artery.

But who has coronary plaque? If we knew, we could specifically treat the plaque-afflicted individual who also shows M.O.S.T. Protocol abnormalities. In such patients, aggressive treatment should be given to stabilize the plaque. Identifying patients who have non-flow-limiting plaques can be difficult and expensive. Treadmill tests assess the possibility of flow-limiting coronary plaque. However, all coronary plaques can be dangerous, especially for people with M.O.S.T. Protocol abnormalities. Fortunately, a new plaque-detecting device has become available. Called Electron Beam (Ultra Fast) Computerized Tomography (EBCT), this simple, safe, painless test takes only a few minutes to search the coronary arteries for the presence of plaque. To be more precise, the EBCT actually detects the calcium material present in coronary plaque structure. It provides the most accurate method currently available to determine whether an individual has asymptomatic atherosclerosis (see Chapter 3).

Once plaque is detected by EBCT, a treadmill test can determine whether the plaque limits blood flow and point to cardiologic interventions that need to be considered. Most often at this stage, however, the coronary plaque is not limiting coronary blood flow. But since plaque can kill all the same, aggressive noradrenaline and plaque stabilization efforts need to be incorporated into long-term medical management, including the treatment strategies described below. Remember, a normal treadmill test (and related tests) confirms the absence of ischemia (i.e. coronary blood flow limitation) but not the absence of plaque. Abnormal M.O.S.T. Protocol findings warn for potential plaque danger. The EBCT detects calcified plaque. When detected, plaque formation should be halted and reversed.

*Clot.* When you wake up and go to work, your blood clotting quickens and becomes more tenacious. This is not good in routine circumstances, and it is especially dangerous in the presence of plaque. Further concern with clotting arises if a poor response is demonstrated with the M.O.S.T. Protocol. Blood pressure spikes during times of mental intensity signal that clotting may be more aggressive than usual. The abnormal plaque detected on the EBCT heightens the need for clot control because a plaque fracture could occur in the coronaries, providing a susceptible site upon which an occluding coronary thrombosis (clot) could develop. However, further clot testing is not usually necessary. Your physician may merely prescribe an aspirin per day to bring the clotting back to normal. If you show no plaque on the EBCT, a high dose of Vitamin E (i.e. 400 to 800 IU) and various healthy lifestyle choices should alleviate your clotting concern.

*Electricity.* Noradrenaline from the intensity of life can trigger all forms of arrhythmias. Therefore, rhythm disturbances are much more likely to occur during the stress of the workday. A heart with abnormal muscular thickness, stiffness, and/or stretching, as well as one with excessive atherosclerotic plaque development, is especially susceptible to arrhythmia. Palpitations, which are symptomatic signals of arrhythmia, also require further medical evaluation. An electrocardiogram (EKG) measures the electrical activity of the heart and sheds light on cardiac electrical stability. The EKG readings are standardized with certain rates, waves, spaces, and intervals determined as normal while at rest as well as while exercising. Deviation from a normal rhythm requires further medical evaluation. Twenty-four-hour monitoring of cardiac electrical activity by a special type of EKG can be very useful in evaluating the effects of noradrenaline and mental intensity on palpitations and arrhythmia, especially when coupled with resting and exercise EKG measurements.

Even the most basic assessment of heart rate can indicate the need for action. For example, according to the Framingham Heart Study, a fast pulse (i.e. 80 beats or more per minute at rest) in a worker with high blood pressure is a signal of excessive sensitivity to noradrenaline and is a marker for premature adverse outcomes such as heart attack.<sup>12</sup> Simple preventive strategies can be adopted at this early time to forestall problems.

In later life, cardiac electrical problems arise as a result of the weakening in coronary circulation or the cardiac muscle, thus aggravating these vascular and muscular concerns. Arrhythmias arising in a heart with totally normal cardiac muscle and unoccluded coronary circulation are rare and often congenital. However, they too can be triggered by noradrenaline. The M.O.S.T. Protocol helps predict these and other arrhythmic sensitivities.

*Muscle.* The heart muscle is designed to work tirelessly to transport blood throughout the body in a rhythmic series of contractions that move this life-sustaining fluid through four cardiac chambers to parts distant. The upper chambers are primarily holding tanks (the atria) which receive blood from the body. These upper chambers then send their contents through one-way valves into the pumping chambers (the ventricles) below. The transit valves close and the exit valves open while a forceful contraction of the cardiac muscle ejects most of the contents from the ventricles. The left side of the heart is the most powerful, since the left ventricle, which sends oxygenated blood out to the body, is the primary muscular pumping force of the heart. Blood vessels (the coronary arteries) on the surface of these chambers

branch to supply fuel to the working heart muscle. Noradrenaline stimulates these blood vessels to become clogged with atherosclerotic plaque and occluded through coronary thrombosis.

Noradrenaline also helps cause the cardiac muscle itself to become stretched (left atrial enlargement, left ventricular enlargement), stiffened (left ventricular diastolic dysfunction), or thickened (left ventricular hypertrophy or LVH) after years of intense stress. In fact, a heart can be dangerously thickened even with no plaque buildup in the arteries. The M.O.S.T. Protocol provides excellent screening assistance in identifying potential for cardiac muscular abnormality. Blood pressure measured during mental stress challenges is the best clinical predictor of LVH.<sup>13</sup> The M.O.S.T. Protocol blood pressure readings identify noradrenaline-related blood pressure surges, which thicken the heart.

Testing for cardiac muscular abnormality is very important. Echocardiography (cardiac ultrasound) should be considered whenever an adverse M.O.S.T. Protocol finding occurs. However, the most dangerous LVH is usually preceded by several years of cardiac muscular stiffness or diastolic dysfunction. This can be detected with a stethoscope, which picks up noise called an S4 gallop when the heart has stiffened due to too much noradrenaline exposure over the years. An adverse M.O.S.T. Protocol finding plus an S4 gallop indicates the need for echocardiography. Echocardiography can be performed during a repeat performance of the M.O.S.T. Protocol to identify cardiac stiffness that might only occur during the actual stressful event. In that case, therapeutic intervention in the process could begin even earlier if indicated. We should note that a thick heart with LVH can occasionally be normal if the thickness is due to a good exercise program. A thick heart is considered normal if it is flexible and supple, thus lacking the stiffness associated with adverse responses to noradrenaline and blood pressure load.

In sum, the M.O.S.T. Protocol detects physiological stress susceptibility. Intensity intervention through many avenues then begins to heal the employee and, in the aggregate, the company as well. Treatment, as well as the evaluation and advanced testing previously recommended, is multidimensional, moving from the simple to the complex: the earlier the intervention, the simpler the approach. The necessary degree of sophistication of the treatment and the testing is best determined when the additional screening factors of cholesterol, blood pressure, diabetes, body weight, genetic risk, and physical fitness are factored into the equation. An abnormal M.O.S.T. Protocol alerts the health care team to institute interventions at an even earlier point than other standard risk assessments.

## **LIFESTYLE INTERVENTIONS**

*Exercise.* Aerobic exercise, the kind that makes your heart race and your breathing faster, is an excellent antidote for all the cardiovascular consequences of mental intensity. It benefits everyone but is especially important for those who fail on the M.O.S.T. Protocol, indicating they are especially sensitive to the noradrenaline of stress. Regular aerobic exercise is able to reduce the excessive noradrenaline of stress. Aerobic activity also beneficially affects plaque shear forces, heart rate and other arrhythmias, cholesterol

profiles, excessive clotting, and heart musculature. Essentially, it is one of the few things that you can do to improve all of the cardiovascular consequences of mental intensity.

Many books have been written about proper exercise and its benefits. The best of these is the series by Kenneth H. Cooper, M.D., founder of the Cooper Aerobics Center in Dallas, Texas. His writings will be an excellent guide to both the individual and the organization for establishing exercise programming to develop “intensity heartiness.”

*Nutrition.* Proper nutritional habits are an effective intervention for cardiovascular disease. A failure on the M.O.S.T. Protocol warrants additional nutritional efforts. Alcohol reduction, caffeine control, increases in dietary fiber (e.g. fruits, vegetables), reduced dietary fat, controlled calories, and avoidance of refined sugars can all assist in the battle. A diet high in potassium, magnesium, calcium, fish, and fiber, but low in calories, caffeine, alcohol, fat, sugar, and saturated and polyunsaturated fats (particularly hydrogenated) can combat the cardiovascular consequences of mental intensity.

In the past, advanced nutritional therapies have been the subject of ridicule from the medical profession. However, several important “nutriceutical” therapies have emerged with substantial medical support. Antioxidants such as Vitamin E and Vitamin C have been found to have a very favorable effect on reducing the oxidation of cholesterol within the coronary plaque. Vitamin E may also attenuate clotting. Folic acid reverses the potential coronary risk of elevated homocysteine. Vitamins B6 and B12 may be very useful during times of stress. As stated before, the Cooper Aerobics Center is a good place to start (along with Chapter 8 in this book) for sound advice regarding cardiovascular and general nutrition as well as advanced nutritional therapies. Georgia Kostas, M.S., R.D., and her staff assist Dr. Cooper in the promulgation of appropriate nutritional advice for the individual and the organization.

*Weight Control.* Excess body weight and fat worsen M.O.S.T. Protocol scores. The problem should be addressed at both the individual and the organizational levels. However, weight and fat hardly need to be treated as separate problems if the nutrition and exercise programming are optimized.

*Stress Management.* Exercise, good nutrition, and weight control provide the basic physiological strategies for stress control programming at the individual and organizational levels. These efforts allow the stress to occur in a lean, sleek, well-oiled body that can stand a lot of punishment. Certainly, they also assist in improving the psychology of stress and intensity. However, the psychological aspects have not really been addressed until more formal stress management training has been instituted. It has been demonstrated that even simple sessions of abdominal breathing training can beneficially impact an abnormal M.O.S.T. Protocol.<sup>14</sup> Additional efforts with progressive muscle relaxation, biofeedback, prayer, meditation, cognitive restructuring, and other more advanced techniques can provide further assistance where needed (also see Chapter 5 of this book). The writings of Dr. Cooper, Robert S. Eliot, M.D., Herbert Benson, M.D., Stephen Fahrion, Ph.D., and Redford Williams, M.D., provide excellent frameworks for the development of the psychological and stress management components of a “stress heartiness” program.



## MEDICAL INTERVENTIONS

One of the great advances in preventive cardiology is the advent of multiple medications that can effectively forestall the progression of the cardiovascular consequences of mental intensity with few side effects. In the past, medications were viewed with suspicion if not disdain by many in the preventive arena. However, they have now become the cornerstones of heart attack prevention strategies, complementing and closely allied with lifestyle interventions.

Medicinal therapy should be used on all patients with any form of cardiovascular disease (i.e. even to include early M.O.S.T. Protocol failures). Obviously, the non-drug therapies described earlier should also be implemented. But if the intensity is high or the body susceptible, drug strategies should be implemented. Beta-blockers, commonly known as a type of medicine to treat hypertension, have now become the standard of care for advanced cardiovascular disease. Most cardiologists use beta-blockers to treat advanced plaque and electrical and muscular abnormalities of the heart. Why? Because beta-blockers “block” the effect of noradrenaline on the heart, thus protecting the very sick heart afflicted with advanced atherosclerosis, accelerated arrhythmia, and cardiac muscular failure.

Are beta-blockers the best choice? Certainly they are an excellent choice for patients who have just suffered a heart attack. However, for patients with high blood pressure, the preferred agent would control noradrenaline levels similarly to beta-blockers, but without the potential bad side effects common with these agents. The beta-blocker, for example, may cause fatigue, depression, and impotence, and it is also problematic when the patient also suffers from high cholesterol and asthma.

Verapamil, a calcium channel blocker, is the drug of choice for many practitioners who treat high blood pressure. It lowers noradrenaline by 30% without the side effects of a beta-blocker.<sup>15</sup> Verapamil decreases clotting, lowers the heart rate, controls arrhythmia, reduces the shear forces on the coronary plaque, dilates coronary arteries, reverses cardiac muscular thickness, and effectively lowers resting blood pressure and controls M.O.S.T. Protocol blood pressures as well.<sup>16</sup> In fact, it is the only single drug that controls all four horsemen of mental intensity. Your doctor should consider verapamil as the cornerstone therapy for high blood pressure just as the cardiologist builds therapy for sicker patients around the beta-blocker. Recently, verapamil has also been packaged in a stress-correlated delivery system in which the drug is taken at night with a delay coat around the pill that dissolves after 5 hours to release the majority of the drug into your system during the workday when it is needed the most.

Medicines called ACE (angiotensin-converting enzymes) inhibitors, as well as angiotensin receptor blockers (ARBs), also are outstanding for high blood pressure, especially when combined with verapamil. Alpha-blockers, diltiazem (another calcium channel blocker), low-dose diuretics, and other medications may be useful as well. Obviously, these are treatments to be discussed with your doctor, but you will especially want to discuss the advisability of a noradrenaline strategy.

Interestingly, one of the most widely prescribed groups of medicine for high blood pressure is the dihydropyridine calcium channel blockers (i.e. amlodipine, felodipine, nifedipine, isradipine, nisoldipine, nicardipine, etc.). These drugs are highly effective at lowering blood pressure, but they actually increase noradrenaline levels by 17% according to a recent review of the medical literature.<sup>17</sup> This may explain why these drugs look good in medical studies only when they are used like a cardiologist uses them—always in combination with a beta-blocker to block the effect of increased noradrenaline levels. Verapamil plus an ACE inhibitor or ARB is a much better strategy for “trigger” control. The world’s medical literature validates such choices where the goal of treatment is to save the heart, brain, and kidneys and not just lower blood pressure.

Significant advances in the management of elevated cholesterol have been made as well with the advent of drugs known as “statins.” These drugs dramatically improve the cholesterol profile, but even more important they are powerful plaque stabilizers. Statins shrink coronary atherosclerotic plaques through the process of reducing the pooled liquid cholesterol swelling the plaque. This then reduces the inflammatory weakening of the plaque at its edges. The “hide” over the plaque is toughened and made more resistant to the shear forces and vessel constrictions that occur during the M.O.S.T. Protocol as well as during the intensity of the workday. Statin drugs are mandatory, I believe, if the M.O.S.T. Protocol is abnormal and there is plaque detected on the EBCT. Keep in mind that our goal is more urgently plaque stabilization than cholesterol lowering. Recent studies have shown that even people with normal cholesterol levels have fewer heart attacks when treated with statins.<sup>18</sup>

How about aspirin? This wonderful clot controller should be considered for administering after all M.O.S.T. Protocol failures. Remember, the same noradrenaline that raised the blood pressure also accelerated the clotting of blood. Taking aspirin must be discussed with a physician. The data are compelling, however, in terms of aspirin’s benefit after both EBCT and M.O.S.T. Protocol failures. A recent study from the Harvard Hospital System confirmed that angry men had a higher heart attack rate than non-angry men. However, a sub-group of angry men taking aspirin regularly had heart attacks at a rate closer to that of non-angry men. The anger may have surged blood pressure and fractured plaque, but with patients taking aspirin, a coronary thrombosis or clot was less likely to form.<sup>19</sup>

Obviously, medication strategies can be critical to healthy intensity management. Thus individuals need to receive medication choices for noradrenaline and intensity management. However, I believe that involvement in medicine choices can be practical and important even at the organizational level. Medical education, physician discussions, and intensity-related medical goal-setting can and should be facilitated through organizational medical plans.

Medical management of the cardiovascular consequences of mental intensity is like the safety net under the trapeze act in a circus. The executive is on the trapeze facing challenges and new performance routines daily. The M.O.S.T. Protocol and other diagnostic tools indicate the executive’s grip on the swing may be slipping. Exercise physiologists, nutritionists, psychologists, and spiritual leaders are the trapeze instructors teaching life management skills. But when all else fails, the physician with his formulary of medications

acts like the circus maintenance man strengthening the safety net to protect the executive while he or she learns how to better manage the trapeze.

## **SUMMARY CASE STUDY**

The following case provides a real world example of the benefits of the approach presented in this paper.

John was an apparently healthy 54-year-old corporate executive trained in law. His degree served him well as he climbed the corporate ladder to secure a senior vice-presidency. He had no significant complaints of either mental stress or physical symptoms of cardiovascular disease. His health profile was normal on regular screening examinations each year. Treadmill tests were normal and his last cholesterol level was a low 169 mg/dl with 49 mg/dl of that being the protective HDL type of cholesterol. He did have high blood pressure, however, and his internist placed him on the calcium channel blocker amlodipine, reducing his resting blood pressure to a normal 135/85 mm Hg.

But this year his corporation recommended him for a much more aggressive preventive cardiology assessment centered on intensity medicine. John participated in a new test called the M.O.S.T. Protocol, during which he was asked to subtract numbers in reverse order to create some stress. Amazingly, his blood pressure rose to 186/107 during this simple mathematics challenge, despite amlodipine therapy. He was told that the amlodipine was not the best drug to control factors related to the intensity of work.<sup>20</sup> The drug amlodipine (though effective at controlling resting blood pressure) was not a plaque stabilizer, clot stabilizer, electrical stabilizer, or intensity stabilizer, which control the "triggers" for cardiovascular events.

This information became especially important to John when another new test called the EBCT scan showed that he had four previously unknown places in his coronary arteries where atherosclerotic plaque was accumulating. Therefore, a switch from amlodipine to verapamil was recommended to provide better intensity control and plaque stabilization. Verapamil would reduce the shear forces on the plaques, as well as the powerful contractions of the heart during stress. It would also lower clotting and heart rate, unlike amlodipine.

The treadmill continued to be normal, so that there would likely be no need for invasive testing and/or intervention. However, since up to 70% of heart attacks occur in blood vessels that are not clogged enough to cause chest pain or show up as abnormal on a treadmill, plaque stabilization beginning with verapamil would be pursued even more aggressively with the addition of a statin drug to treat cholesterol. John asked why treat his cholesterol when it was only 169 mg/dl. He was told that the most important aspect of the statin drug was its action as a plaque stabilizer and plaque shrinker. Aspirin was added to cut down the possibility of coronary thrombosis. Advanced nutritional supplementation with Vitamins C, E, B6 and B12 plus folic acid were added to his daily regiment to combat oxidation, stress, and homocysteine (other aggravators of plaque).

An echocardiogram or ultrasound of the heart revealed thickened and stiffened heart walls, so an ACE inhibitor was added to the verapamil to further accelerate the return of the heart muscle to normal. This muscular improvement should occur in 6 to 12 months, eliminating the minor premature contractions noted on electrocardiographic monitoring during the treadmill.

A refresher course on proper nutrition and exercise, along with some executive hints about noradrenaline control in the workplace through relaxation breathing, completed the process. Repeat testing at intervals would document reversal or stabilization of the triggers—the four horsemen of intensity—of the cardiovascular consequences of mental intensity.

Sure enough, a year later, John was lean and fit. However, even more importantly, after the elapse of still another year, a repeat EBCT scan showed coronary plaque stabilization, a repeat echocardiogram demonstrated reversal of heart muscle thickness and stiffness, and a repeat treadmill EKG revealed the absence of abnormal cardiac electrical patterns. The four horsemen had finally dismounted.

## ENDNOTES

1. P. M. Ridker et al., "Primary Prevention of Ischemic Heart Disease," in *Cardiovascular Therapeutics*, ed. T. W. Smith, Philadelphia: W. B. Saunders, 1996.
2. S. N. Willich et al., "Sudden Cardiac Death: Support for a Role of Triggering in Causation," *Circulation*, Vol. 87, 1993, pp. 1442-1450.
3. M. J. Budoff and B. H. Brundage, "Electron Beam Computed Tomography: Screening for Coronary Artery Disease," *Clinical Cardiology*, Vol. 22, 1999, pp. 554-558.
4. A. Steptoe et al., "Control Over Work Pace, Job Strain and Cardiovascular Responses in Middle Aged Men," *Journal of Hypertension*, Vol. 11, 1993, pp. 751-759.
5. R. B. Devereaux, T. G. Pickering, and G. A. Harshfield, "Left Ventricular Hypertrophy in Patients with Hypertension: Importance of Blood Pressure Response to Regular Recurring Stress," *Circulation*, Vol. 68, 1983, pp. 470-476.
6. J. E. Muller, P. H. Stone, and Z. G. Turi, "Circadian Variation of the Frequency of Onset of Acute Myocardial Infarction," *New England Journal of Medicine*, Vol. 313, 1985, pp. 1315-1322.
7. N. Cristenfeld et al., "Exposure to New York City as a Risk Factor for Heart Attack Mortality," *Psychosomatic Medicine*, Vol. 61 (6), 1999, pp.740-745.
8. R.S. Eliot, ed., *Stress and the Heart*, Mount Kisco, NY: Futura Publishing, 1974, pp. 48-65.
9. S. N. Willich et al., "Increased Onset of Sudden Cardiac Death in the First Three Hours After Awakening," *American Journal of Cardiology*, Vol. 70, 1992, pp. 65-68.
10. K. A. Matthews et al., "Stress Induced Pulse Pressure Change Predicts Women's Carotid Atherosclerosis," *Stroke*, Vol. 29, 1998, pp. 1525-1530.

11. J. L. Boone, "The Cardiovascular Consequences of Mental Intensity," *Journal of the American Medical Association*, Supplement – Southeast Asian Edition, Vol. 12, No. 3, 1996, pp. 26-28.
12. M. W. Gillman et al., "Influence of Heart Rate on Mortality Among Persons with Hypertension: The Framingham Study," *American Heart Journal*, Vol. 125, 1993, pp. 1148-1154.
13. G. Parati et al., "Relationship of 24-Hour Blood Pressure Mean and Variability to Severity of Target Organ Damage in Hypertension," *Journal of Hypertension*, Vol. 5, 1987, pp. 93-98.
14. S. Fahrion, P. Norris, and A. Green, "Biobehavioral Treatment of Essential Hypertension: A Group Outcome Study," *Biofeedback and Self-Regulation*, Vol. 2, 1986, pp. 257-267.
15. N. H. Wallen et al., "Platelet Aggregability In Vivo Is Attenuated by Verapamil But Not by Metoprolol in Patients with Stable Angina Pectoris," *American Journal of Cardiology*, Vol. 75, No. 1, January 1, 1995.
16. J. L. Boone and J.P. Anthony, "Evaluating the Impact of Stress on Systemic Disease: The MOST Protocol in Primary Care," *Journal of American Osteopathic Association*, forthcoming.
17. E. Grossman and H. F. Messerli, "Effect of Calcium Antagonists on Plasma Norepinephrine Levels, Heart Rate, and Blood Pressure," *American Journal of Cardiology*, Vol. 80, 1997, pp. 1453-1458.
18. J. Shepherd et al., "Prevention of Coronary Heart Disease with Pravastatin in Men with Hypercholesterolemia: The West of Scotland Study Group," *New England Journal of Medicine*, Vol. 333, 1995, pp. 1301-1307.
19. M. A. Mittleman et al., "Triggering of an Acute Myocardial Infarction Onset by Episodes of Anger," *Circulation*, Vol. 92, 1995, pp. 1720-1725.
20. P. Nazarro, M. Manzari, and R. Merto, "Antihypertensive Treatment with Verapamil and Amlodipine: Their Effect on the Functional Autonomic and Cardiovascular Stress Responses," *European Heart Journal*, Vol. 16, 1995, pp. 1277-1286.

## CHAPTER 5

### THE KILLING FIELDS OF ANGER: CAN ANGER BE CONTROLLED?

Aron W. Siegman, Edward A. Franco, and Mark A. Vaitkus

#### INTRODUCTION

It is now widely recognized that a person's life-style, if it includes smoking, a diet high in saturated fat, and lack of exercise, can pose a significant risk for coronary heart disease (CHD)—the major killer of both men and women in the United States. It is less well known, however, that negative emotions such as anger, excessive worry and anxiety, and depression, can also be damaging to one's heart. In this chapter we explain how negative emotions are able to trigger physiological changes resulting in structural changes that can cause death. Although we will have something to say about a variety of negative emotions and their effects on CHD, the focus will be on anger because the link between anger and CHD has received the greatest research attention and is the best understood.

Questions to be addressed in this chapter include the following: Which mode of anger expression—the outward expression of anger or the inward experience of anger—is the most "toxic" as far as CHD is concerned? Are chronic irritability and impatience risk factors for CHD? Do men and women differ in the way they cope with anger and in the modes of anger expression that put them at risk for CHD? What are the physiological and hormonal processes by means of which negative emotions become translated into CHD? And finally, is it possible to modify the manner in which we express anger so as to reduce the risk of CHD?

To answer these and other questions, we draw on a number of studies and research projects, especially on research conducted at the Army Physical Fitness Research Institute, located at Carlisle Barracks, Pennsylvania; and the Normative Aging Study (NAS), a major prospective investigation sponsored by the Veterans Administration, whose participants are male veterans of the U.S. armed forces.<sup>1</sup>

#### CORRELATIONS BETWEEN NEGATIVE EMOTIONS AND CHD

**Type A and CHD.** In the lay community the Type A construct is still the most widely recognized psychological risk factor for CHD, although in the scientific community Type A no longer enjoys the reputation it once did as a CHD risk factor, on par with others such as smoking and high cholesterol levels.

Ray Rosenman, who together with Meyer Friedman first identified the Type A behavior pattern as a risk factor for CHD, defines Type A behavior as follows:

[It is] an action-emotion complex that individuals use to confront the environmental milieus and challenges. The complex involves behavioral dispositions such as aggressiveness, competitiveness, and impatience; specific behaviors such as muscle tenseness, alertness, rapid and intense vocal stylistics, and accelerated pace of activities, and emotional responses such as irritation, covert hostility, and above average potential for anger.<sup>2</sup>

This rather complex definition of Type A behavior can be reduced to three major components: (1) excessive competitiveness, (2) a time-pressured life-style, and (3) anger/hostility/aggression.

Friedman and Rosenman also developed a structured interview for assessing the Type A behavior pattern and in 1975 proceeded to launch a large-scale prospective inquiry, the Western Collaborative Group Study (WCGS), in which 3,154 middle-aged, middle class men, free of CHD at the time of entry into the study, were administered the Type A structured interview. In an 8.5-year follow-up, more than twice as many type As as type Bs had developed various forms of CHD. Despite this and other initial confirmations of the Type A-CHD link, several subsequent studies, including a large-scale prospective study (the Multiple Risk Factors Intervention Trials, or MRFIT), failed to confirm this relationship.<sup>3</sup> Even though Type A behavior, in its fully inclusive sense, is at best only a weak risk factor for CHD, several of its components have indeed emerged in recent research as potent risk factors for CHD.

**Anger and CHD.** The failure of the Type A construct to live up to the high expectations generated by Friedman and Rosenman led researchers to focus instead on anger and hostility. Perhaps the strongest support for the hypothesized anger-CHD link comes from the Mittleman study in 1995 in which it was found that the risk for a heart attack in the 2 hours following an episode of intense outwardly expressed anger is 230% greater than when there is no such anger experience<sup>4</sup>.

Impressive support for the anger-CHD link also comes from the NAS findings<sup>5</sup>. In 1986, 1,225 male veterans free of CHD received the MMPI-2, a self-administered personality test from which we constructed an anger-questionnaire (Appendix 1). At the end of an 8-year follow-up, there were 161 cases with heart-related ailments, including 70 cases of nonfatal myocardial infarction (MI), 31 cases of fatal CHD, and 58 cases of heart-related chest pains (angina pectoris, or AP). There was a significant relationship between the veterans' scores on the anger questionnaire and total CHD (combined fatal CHD and nonfatal MIs), and between their anger scores and angina. The risk of CHD for men scoring in the upper third on the anger questionnaire was more than three times that for men scoring in the lower third. The risk for AP in the high-anger group was more than twice that in the low-anger group. These findings provide strong support for the hypothesis that anger is a significant risk factor for CHD. In fact, in the NAS, the risk for CHD conferred by anger was greater than that conferred by smoking or cholesterol.

**Anger-out, Anger-in, and CHD.** There are two modes of anger expression—outward expression (anger-out) and inward feeling (anger-in). Anger-out entails verbal and physical behaviors, such as shouting, fist-shaking, and facial contortions. Anger-in does not show on the outside, but is experienced solely on the inside through feelings and thoughts. It has been

widely assumed that of the two modes, anger-in is the more damaging to one's heart. In fact, some mental health professionals, fearing the supposed toxic effects of repressed anger, have advocated the periodic, full-blown outward expression of anger, on the assumption that such venting of pent-up anger is therapeutic, purging the person of destructive angry impulses. This notion of catharsis was at the root of the "encounter" movement, popular in the Fifties and Sixties.

Yet the research evidence points to a very different conclusion. The anger questionnaire used in the NAS is loaded with markers focusing on the full-blown outward expression of anger (Appendix 1), both verbal and physical, and it is this scale that correlated closely with evidence of CHD. The reader may wonder, "Couldn't both anger-out and anger-in be significant risk factors for CHD?" To answer this question, we need to turn to a study in which men and women referred for a thallium stress test were rated by their spouses on various anger dimensions by means of C. D. Spielberger's State-Trait Anger Expression Inventory, or STAXI. A factor analysis of these anger ratings yielded an impulsive anger-out factor and an anger-in factor. Only patients' anger-out scores, not their anger-in scores, correlated significantly and positively with documented CHD as determined by the thallium stress test findings and by their medical histories.<sup>6</sup> However, as we shall see later, the total repression of anger is also a risk factor for CHD, but apparently not as much as the full-blown outward expression of anger.

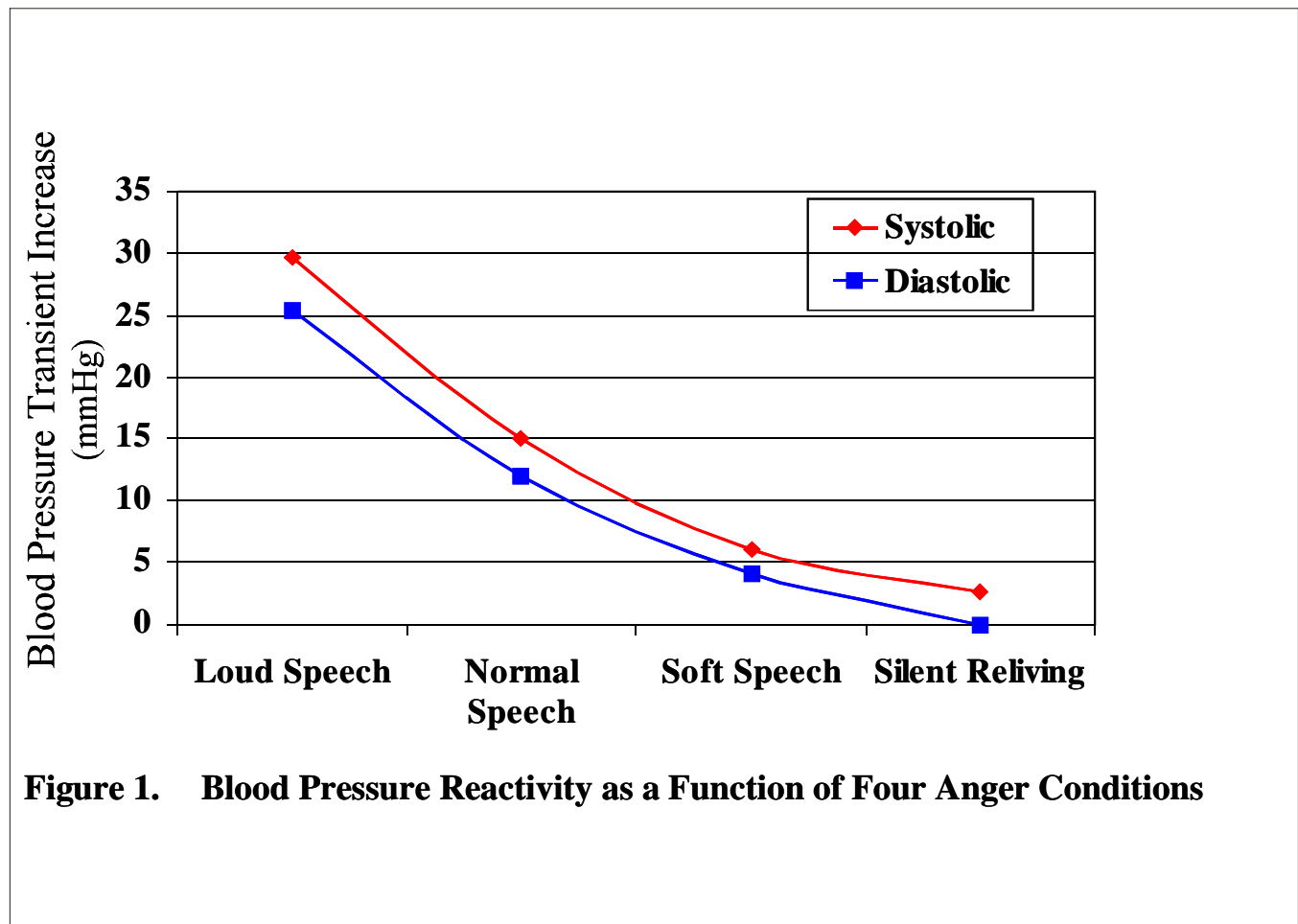
With regard to anger expression, it is also frequently assumed that there are major gender differences, with men tending to express anger outwardly and women tending to experience anger inwardly. Our findings indicate that if such was the case in the past, it is less true today. Women now also express their anger outwardly, except that they may do so more subtly and more indirectly than men. After all, there is a price to be paid for the outward expression of anger, and women may have reason to be more sensitive to these social consequences than men.

**The Bridge that Links Anger-out and CHD.** To understand why anger-out is such a strong risk factor for CHD, and anger-in is not, we need to understand the nature of emotions. Emotions consist not only of thoughts and feelings, but also have physiological, hormonal, and neurohormonal manifestations. These physiological, hormonal, and neurohormonal manifestations of emotions constitute the bridge that links negative emotions with disease processes. Furthermore, each of the negative emotions seems to be associated with a unique pattern of physiological, hormonal, and neurohormonal changes, which in turn are associated with a specific disease process. Thus, anger is uniquely associated with exceedingly high levels of both systolic (the upper number) *and* diastolic (the lower number) blood pressure reactivity. Such hyperreactivity damages the coronary arteries, and can result in transient deficiencies of blood supply to the heart (ischemia), and ultimately in a heart attack (MI). But not all types of anger experience produce such high levels of cardiovascular reactivity.

A series of studies conducted by Aron W. Siegman and S. Cappel-Snow investigated the effects of different types of anger experience on cardiovascular reactivity.<sup>7</sup> Included in this comparison were discussion by the subject in a loud and angry voice of previously experienced anger-arousing events; discussion in a normal voice of previously experienced anger-arousing



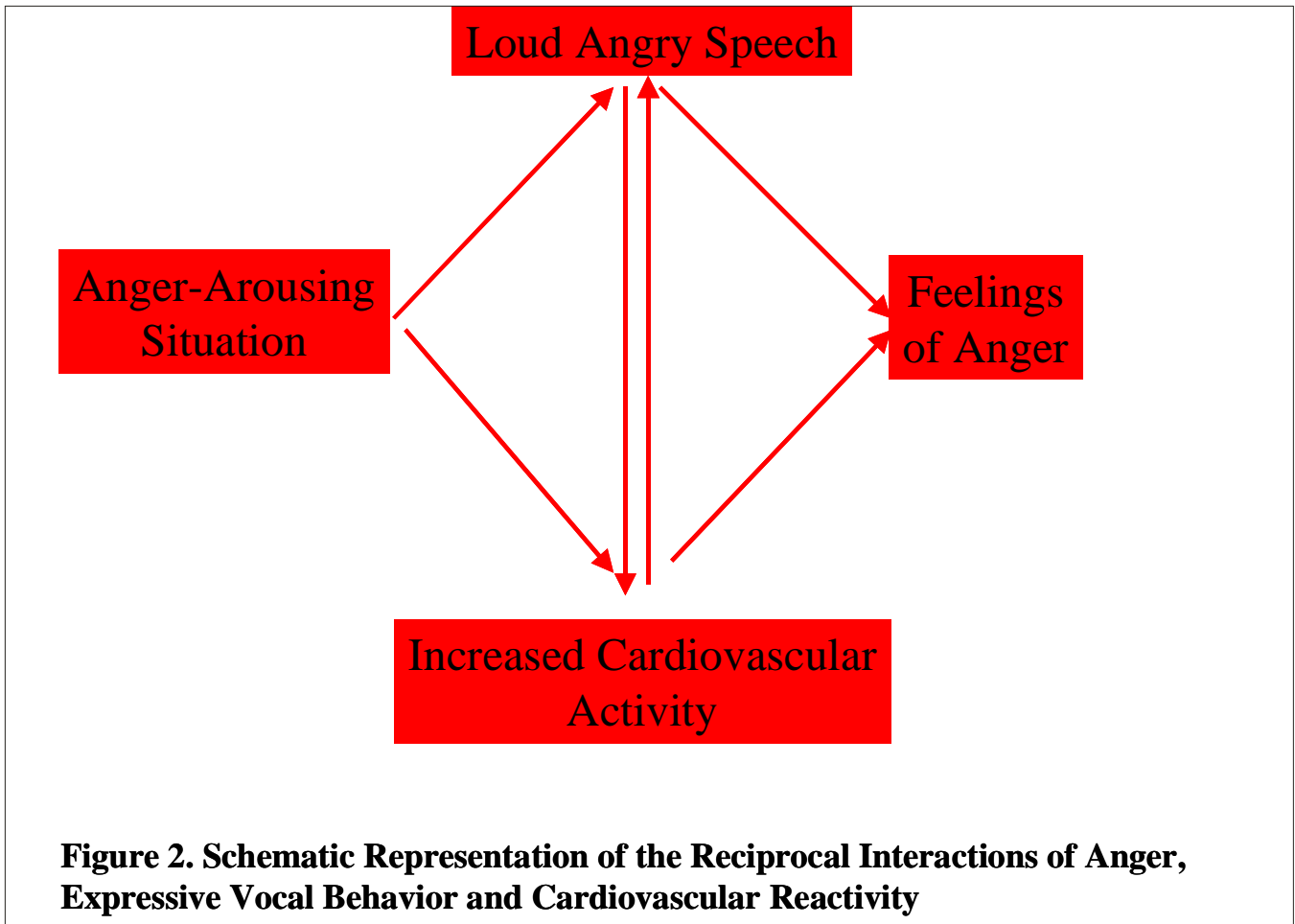
events; discussion in a soft and slow manner of previously experienced anger-arousing events; and the inward silent reliving of previously experienced anger-arousing events. Only the full-blown outward expression of anger, i.e., talking about the anger-arousing events loudly and quickly, was associated with exceedingly high increases in blood pressure (Fig. 1). In a few individuals systolic blood pressure increased by as much as 100 mm Hg, and diastolic by as much as 50 mm Hg. The mean increase in blood pressure was about 25-30 mm Hg. Given these findings, one can readily appreciate why frequent, full-blown outbursts of anger in individuals who are "hot" reactors (i.e., who experience blood pressure increases to exceedingly high levels in response to anger arousal) will eventually result in serious heart disease.



**Figure 1. Blood Pressure Reactivity as a Function of Four Anger Conditions**

Why does loud, angry speech produce such high BP elevations? The answer is that loud speech and blood pressure interact in a reciprocal fashion: as loudness goes up so does blood pressure, and as blood pressure goes up so does loudness. This creates a vicious circle (Fig. 2) which accounts for the high BP levels and for the escalating nature of anger: annoyance turns into anger, and anger turns into rage.

The finding that the discussion of anger-arousing experiences in a normal, pleasant voice is *not* associated with exceptionally high levels of cardiovascular reactivity (CVR) has important implications for the prevention of the negative health consequences of anger



arousal. Especially intriguing, from a preventive medicine point-of-view, are the findings that discussion of anger-arousing events in a *soft and slow* speech style is associated with near zero increases in CVR. This approach and other ways of reducing the negative consequences of anger arousal will be presented later in this chapter.

**Anger and Hypercholesterolemia.** Current research is beginning to move away from an exclusive focus on the role of heightened cardiovascular reactivity as the mediator of the anger-CHD relationship. Other factors are properly receiving attention, such as the potential role of cholesterol. Researchers at the Army Physical Fitness Research Institute of the U.S. Army War College have pioneered in studying the relationship between anger, on the one hand, and lipid and glucose levels, on the other, in healthy men and women. An analysis of data collected on 103 women—officers and civilian students at the Army War College—showed that an angry temperament, poor anger control, and the full-blown outward expression of anger are associated with heightened total cholesterol and heightened low-density lipoprotein (LDL) levels (LDL being the so-called bad cholesterol). Angry temperament and poor anger control were also associated with heightened fasting glucose levels. Further analyses revealed that these positive relationships between anger-out and a negative lipoprotein profile and heightened glucose levels occurred only in women whose physical fitness ranged from poor to normal, not in women whose physical fitness was

excellent. Excellent physical fitness neutralized the negative impact of an angry temperament and poor anger control on lipid, lipoprotein, and glucose levels.

Unlike anger-out, the mere inward experience of anger, or anger-in, did not produce increases in cholesterol or glucose levels. In fact, in our sample of female subjects, the correlations between the Spielberger anger-in scores and triglyceride/cholesterol levels were consistently negative and occasionally significantly so. Our finding that in women only anger-out, but not anger-in, is associated with a bad lipid profile, has been confirmed in a recent study by E. C. Suarez and associates.<sup>8</sup>

So far, the discussion has focused on the relationship between anger expression and cholesterol levels in women. What about this relationship in men? A study conducted at the U.S. Army War College of senior male Army officers yielded findings similar to those reported earlier for women: (1) a positive relationship between anger-out, total cholesterol, and LDL; (2) a significant negative relationship between anger-in and triglycerides; and (3) an increasing magnitude in the relationship between anger-out and a negative lipid profile as additional risk factors were included.<sup>9</sup> However, subsequent studies at the War College failed to confirm these early findings as far as the men are concerned.

Interestingly, a study conducted in Germany in 1995 compared the relationship of two types of anger expression, namely, anger-out and an assertive but non-angry and non-provocative discussion of one's angry feelings called "anger-discuss," and participants' lipid profiles. Anger-out was associated with a negative lipid and lipoprotein profile (higher cholesterol and triglyceride levels), but the anger-discuss had no such negative consequences. In fact, anger-discuss was associated with a favorable lipid profile. There were no gender differences in regard to these findings.<sup>10</sup> Similarly, a study in 1991 found that the outward expression of anger was related to heightened levels of total serum cholesterol and LDL in both men and women.<sup>11</sup>

How are we to explain the discrepancy between the recent lack of positive findings obtained with our senior male Army officers and the positive findings obtained in studies based upon subjects recruited from the population at large? It must be remembered that our senior Army officers are a select group of individuals who have achieved high rank in the U.S. Army because of their leadership qualities. Moreover, they are exceptionally physically fit individuals, with relatively few in the high-risk category levels. The restricted range of their cholesterol scores, which were relatively low, may be responsible for our failure to find the expected positive correlations between our anger measures and their cholesterol levels. Perhaps more importantly, our findings suggest that a high level of physical fitness in men, as was found in women, neutralizes the expected positive relationship between anger-out and a negative lipid profile.

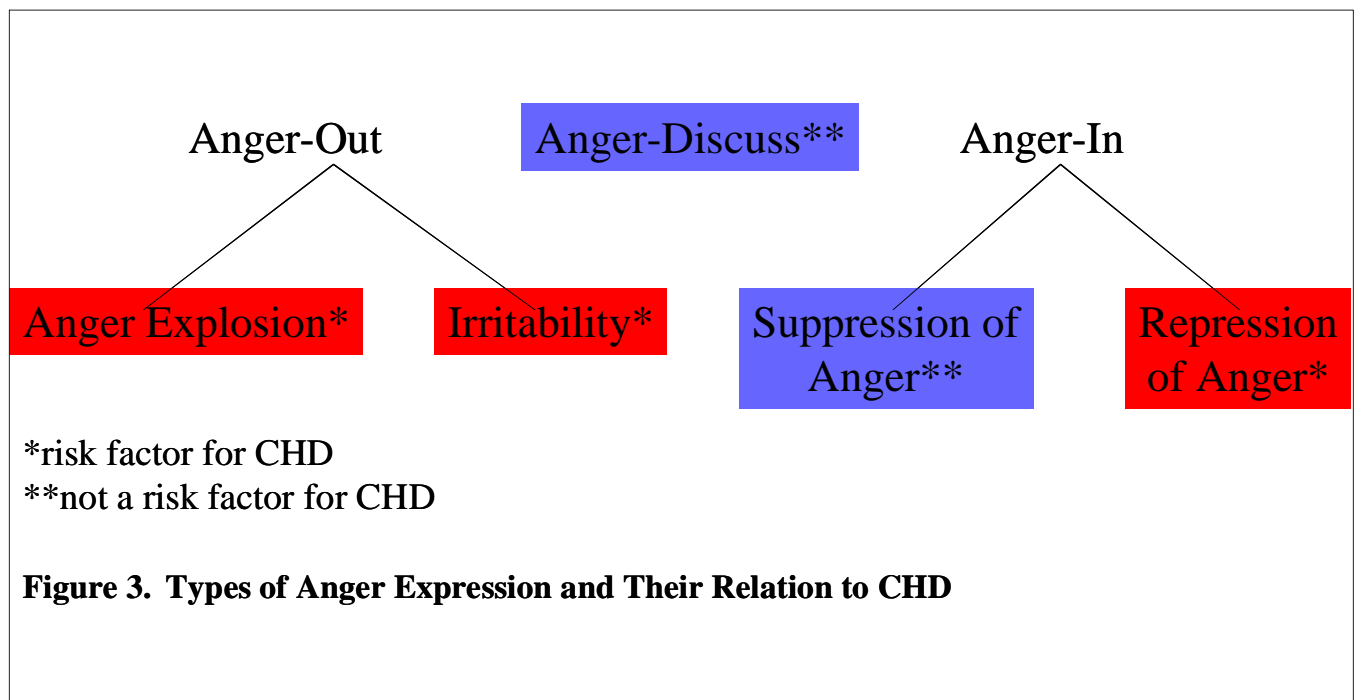
To summarize this section: (1) the weight of evidence suggests that anger-out is associated not only with cardiovascular hyperreactivity, but also with a negative lipid profile; and (2) the evidence also suggests that discussion of one's angry feelings in a non-provocative, non-angry manner is associated with a favorable lipid profile. For some time now, psychotherapists have maintained that an assertive, yet non-provocative discussion of one's angry feelings is

the proper alternative to anger-out, or to its massive repression. The emerging evidence indicates that such socially assertive anger coping (anger-discuss) is indeed the preferred mode of dealing with anger from both a mental health and physical health perspective.

**Impatience-Irritability, Repression, and CHD.** The full-blown outward expression of anger is clearly a significant risk factor for CHD, but it is by no means the only mode of anger-out that is a strong risk factor. Recent findings show that impatience-irritability (Appendix 2)—a highly attenuated form of anger-out expression—is no less of a risk factor for CHD than the full-blown outward expression of anger. We suggest that in addition to the role of exaggerated cardiovascular reactivity in CHD, we need to consider the frequency or chronicity of cardiovascular arousal. Impatience-irritability is not a rare event. In people so inclined, impatience-irritability tends to be a chronic condition. Even if occasional moderate cardiovascular arousal is not a significant risk factor for CHD, chronic arousal may very well be a quite significant CHD risk factor.

Finally, there is evidence that in addition to anger-out, its polar opposite, namely, the total *repression* of anger, is also a risk factor for CHD. The difference between anger *repressors* and anger *suppressors* is that the latter are aware of their angry feelings and the former are not. Repressors will tell you that they rarely, if ever, experience feelings of anger. The repressors themselves truly believe that they are not angry people, although it is apparent to everyone else that they are. Such massive denial comes at a price: it raises blood pressure and ultimately damages the heart, but probably less than the full-blown outward expression of anger.<sup>12</sup> Figure 3 is a schematic representation of the various forms of anger expression and their relation to CHD.

The challenge facing mankind at the dawn of the new millennium is to strike a balance between over-control and under-control of anger. The negative social and health



consequences of under-control are obvious and well-documented. However, over-control too has negative health and social consequences. Earlier we referred to the link between total repression of anger and CHD, and there is evidence that highly over-controlled individuals can be at risk for committing homicide.<sup>13</sup> Perhaps the permissiveness or under-control of recent times is a reaction against the over-control of earlier times. Clearly, we need to develop social institutions and child-rearing strategies that control anger without imposing over-control.

**Other Negative Emotions Associated with CHD.** Thus far our discussion has focused on the link between anger and CHD because, as pointed out in the introduction, this link has received the most sustained research attention and consequently is the best understood in the field of behavioral medicine. However, other negative emotions also confer risk for CHD, and we now turn our attention to these relationships, albeit briefly.

Results from the Normative Aging Study indicate that anxiety too is a risk factor for CHD.<sup>14</sup> Anxiety, like anger, is multidimensional and its different dimensions are associated with different manifestations of CHD. The major manifestations of anxiety are: physiological, cognitive (worrying), and low self-esteem. See Appendix 3 for sample markers of these conditions. In the NAS, the physiological manifestations of anxiety had the most serious consequences for CHD, posing a significant risk for fatal CHD, nonfatal heart attacks, and angina. Cognitive manifestations of anxiety were a significant risk factor for nonfatal heart attacks and angina, but not for fatal CHD. Low self-esteem was a significant risk factor only for angina. These findings suggest that different manifestations of anxiety are associated with different manifestations of CHD.

Depression too plays a role in CHD.<sup>15</sup> Many of the depression-CHD studies are retrospective and correlational, and therefore do not reveal whether depression is a *cause* or merely a *consequence* of CHD. Moreover, in the NAS, depression was a significant risk factor for angina pectoris, but not for more serious CHD outcomes, such as MI and death.<sup>16</sup> There is strong evidence, however, that depression predicts recurrent CHD events, i.e., CHD events after an initial MI. Most notable in this regard is a prospective study that found a five-fold greater risk of mortality among depressed, post-MI patients than among their non-depressed counterparts.<sup>17</sup> It would seem, then, that not only anger, but anxiety and depression too play a role in CHD.

In addition to the negative emotions like anger, anxiety, and depression, there are also some personality traits and behavior patterns that can put one at risk for CHD. For example, in the NAS the need to dominate and control others, as measured by an MMPI-2 derived Dominance Questionnaire (Appendix 4), was a significant risk factor for CHD.<sup>18</sup> High dominance scorers (upper third of the Dominance Questionnaire) were more than twice as much at risk for CHD than low scorers (lower third), independent of their anger levels. In fact, dominance was a better predictor of *fatal* CHD than impulse anger. The high dominance scorers described themselves as competitive, assertive, argumentative, aggressive, defensive of their rights, and desirous of leadership roles. A behavioral manifestation of dominance is the tendency, during a conversation, to hold on to the floor, or to grab the floor from one's conversational partner or interviewer. Using a variety of speech markers of this tendency

(e.g. frequent interruptions), Siegman and associates found that dominance is related to the severity of coronary occlusion and the occurrence of ischemic events in patients referred for angiographic and thallium stress studies.<sup>19</sup> This relationship was clearly evident in men, but not in women.

Of interest in this context are the findings by Kaplan and associates, who worked with cynomolgous monkeys (macaques). They found that dominant monkeys who lived in an environment where their alpha status was frequently challenged were at an increased risk for coronary occlusions compared to non-dominant controls. Furthermore, they found that heightened cardiovascular reactivity is what mediates the dominance-CHD link.<sup>20</sup>

According to some theorists, power assertion or dominance is one of two fundamental characteristics of all social animals (the other being the need for nurture), and it is not to be viewed as an intrinsically negative trait which is bad for one's health. Only if dominance needs put a person in constant competition with his fellow man and cause him to behave aggressively does dominance become a negative force and a risk factor for CHD.

## **THE MODIFICATION OF ANGER AND CHD RISK**

Given the well documented role of anger expression in the development of coronary artery disease, the goal of preventing CHD leads us to two related questions: Can individuals modify their angry behavior in beneficial ways? And if so, what techniques are effective and realistically efficient in doing so?

**Can People Change Their Harmful Angry Behavior?** In 1975, R. W. Novaco became one of the first researchers to demonstrate the effective treatment of chronic anger problems using interventions that target mental (cognitive), physiological, and behavioral aspects of anger. Using techniques that had initially been developed to deal with anxiety disorders, he applied "stress inoculation training" to the treatment of anger problems.<sup>21</sup> This approach assumes that at a cognitive level, anger is a result of a person's perceptions, attributions, expectations, and self-talk. Reduction of physiological arousal through relaxation strategies and the development of more effective behaviors, including enhanced communication, assertiveness, and problem-solving skills, complete the intervention program.

Novaco's original research suggested that while both the relaxation and cognitive components of the stress inoculation model were effective, the cognitive interventions appeared more robust. Subsequent work by D. Miechenbaum has also focused on the cognitive and behavioral elements of anger, emphasizing behavioral rehearsal of anger-provoking situations.<sup>22</sup> Additionally, R.M. Suinn developed an eight-session relaxation therapy for anxiety and anger problems.<sup>23</sup> A recent review of the intervention literature for anger commended several approaches as effective: self-instructional training, relaxation-based management strategies (such as progressive muscle relaxation, anger management drills, and systematic desensitization), and social skills training. Multi-component treatment packages, which included cognitive components, emerged as

most effective. Notably, techniques based on catharsis were found not effective in reducing anger.<sup>24</sup>

J. L. Deffenbacher has comprehensively reviewed the literature on therapeutic intervention with anger problems and suggested that an ideal treatment package for adults with anger disorders can be defined. His admittedly broad approach covers the following aspects: self-monitoring and enhanced awareness; anger response disruption; self-calming strategies (including speaking in a low voice); relaxation coping skills; cognitive restructuring; silly humor; and skill building.<sup>25</sup> Thus there is broad evidence that individuals can learn to modify their angry behavior using a comprehensive cognitive behavioral approach.

**The Most Effective and Efficient Techniques in the Prevention of CHD.** The Army Physical Fitness Research Institute (APFRI) has provided intervention programs to assist senior officers in changing dysfunctional aspects of Type A behavior patterns beginning in the early 1980s. Initially, the program was conducted by Meyer Friedman and his colleagues based on the assessment and intervention techniques described in the Recurrent Coronary Prevention Project Study (1982). These early studies of the modification of Type A behavior used intervention models that focused on time urgency and competitiveness in addition to hostility and anger.<sup>26</sup> Consonant with current thinking, the Type A Behavior Modification Program was redesigned, based on recent research that clearly confirmed that anger and hostility rather than the global Type A pattern better characterizes the risk factors for CHD.

The current program utilizes the LifeSkills program developed by Redford and Virginia Williams. The LifeSkills program is a six-session small-group workshop based on techniques described in the Williams' book *Anger Kills: Seventeen Strategies for Controlling the Hostility That Can Harm Your Health* (1993) and expanded upon in *LifeSkills*.<sup>27</sup> Because both books are written in a very personal and easy-to-read style, participants found the techniques quite effective.

The LifeSkills program deals with all of the aspects that Deffenbacher describes in his ideal treatment package, but presents them in a less technical form. A major goal of APFRI's research is to discover useful, implementable health promotion programs. The Williams' LifeSkills program offered a unique opportunity to study an intervention program that was promising in these regards, and additionally was of relatively brief duration.

**APFRI's LifeSkills-Anger Kills Intervention Program.** The goals of the program focus on managing anger and other negative emotions effectively through mastery of two general sets of LifeSkills—understanding others and ourselves, and acting effectively. The program consists of six 90-minute small-group sessions. The facilitator opens by checking with the group regarding the success and progress of home practice of the skills introduced during the previous session. This is followed by explanation of a new skill and the rationale for its use. The facilitator then models the use of the skill, following this step with a structured exercise in which the participants practice this skill with a partner in the group. Participants are then asked to practice the skill in a “real life” situation during the week, often with family

members, and then record their responses and reactions in order to report back to the group during the following session.

Participants are asked to use a Thoughts and Feelings Log in which they record actual life situations that provoke their anger and irritability during the week. At first, they are asked simply to describe the scene (who, what, when, where) and then record their thoughts, feelings, and behavioral reactions, followed by noting the consequences of their reactions. Later, participants evaluate these log entries by use of a series of questions that address their cognitive appraisal of the situation, using the mnemonic "I AM WORTH IT": I (Is the situation IMPORTANT to me?); A (Is my response APPROPRIATE to the facts of the situation?); M (Is the situation MODIFIABLE in ways that will reduce my negative thoughts and feelings?); WORTH IT (When I balance the needs of others and myself, is taking action WORTH IT?). This approach leads to introduction and use of cognitive restructuring techniques and problem-solving strategies.

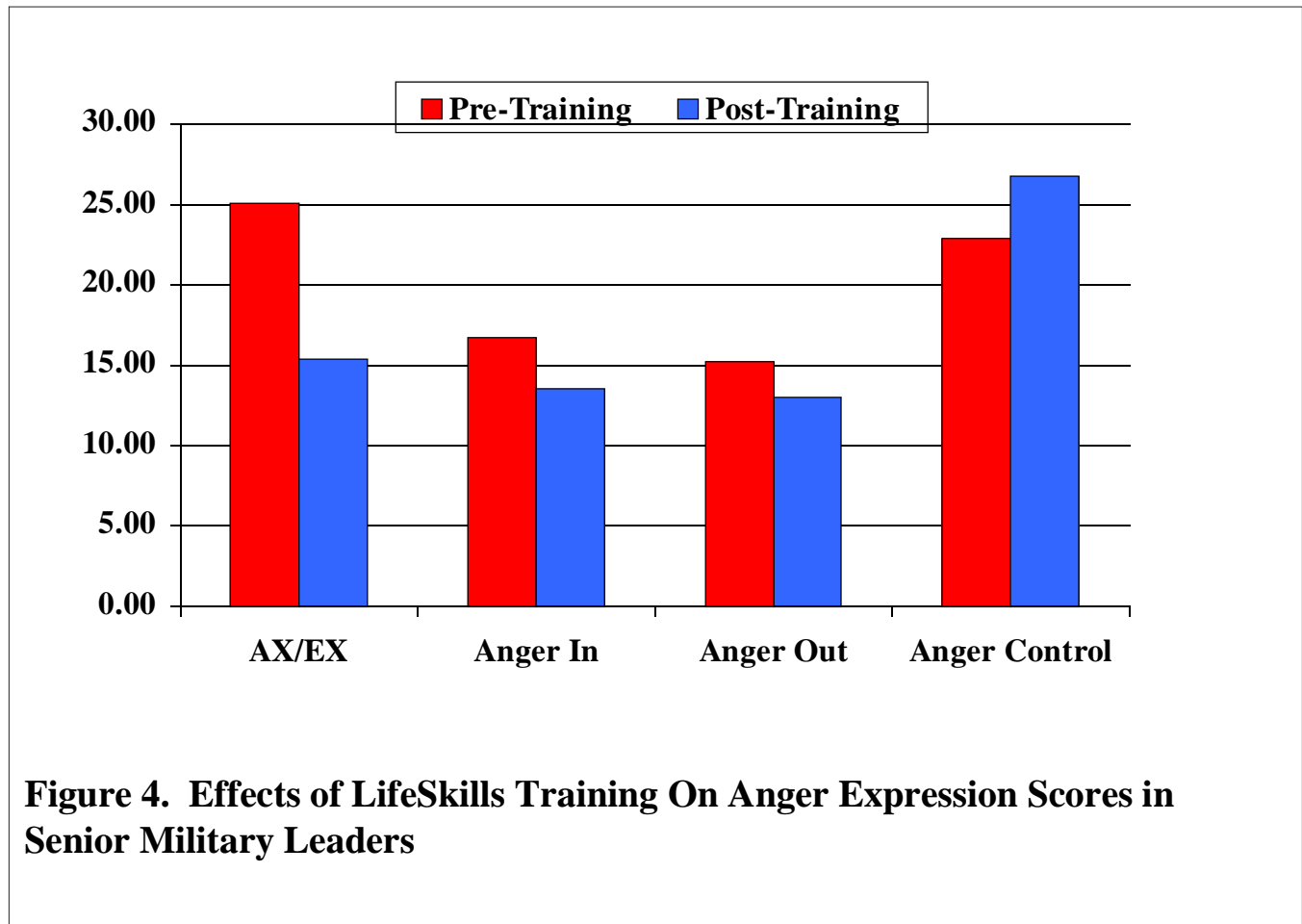
Anger response disruption is achieved through "thought stopping" (saying the word "stop" out loud when the person begins to experience the same angry thoughts over and over) and a number of distraction strategies to shift one's attention off the anger-inducing episode. Relaxation coping skills are taught during the sessions, and three different relaxation/meditation techniques are introduced and then practiced at home using audiotapes. These sessions encourage laughing at oneself, while also honing and building skills related to clear and effective communication, assertiveness, and empathic listening.

**Program Effectiveness.** During Academic Years 1998 and 1999 the effectiveness of the LifeSkills intervention program was studied, using male subjects. Data were analyzed from 33 predominantly uniformed military leaders who completed the program and 23 senior military officers who were used as a control group. The group of 33 had responded to an invitation to participate in a six-session anger management program based on the LifeSkills Program of Redford and Virginia Williams because they were identified as being at high risk for cardiac-related health problems based on their scores on the Spielberger State-Trait Anger Expression Inventory (STAXI). The AX/EX summary score of the STAXI was used to select the highest 20% (i.e. those at highest risk) of the 250 students who took the test as part of a larger ongoing study of cardiac health and fitness. In addition, students who scored at the 90<sup>th</sup> percentile on any one of the three subscales of anger-out, anger-in, or low anger control were also included. Following the six-session intervention program (approximately 3 months later), they were again administered the STAXI and these scores compared to their pre-intervention scores. As may be seen in Figure 4, participants' anger-in, anger-out, and AX/EX summary scores were significantly lower following the intervention and their anger control score significantly increased.

Because the year-long program at the Army War College differs significantly from regular military assignments, it was necessary to determine whether simply being enrolled at the War College (where presumably a more relaxed climate prevails) might have had a positive effect on stress and anger levels. A control group was formed, made up of a random sample of students who did not score high on the STAXI initially. Thirty-one students were sent a follow-up STAXI at the same time that study enrollees were completing the intervention



program. Twenty-six completed STAXIs were returned (return rate of 84%) from this group, including those from three women. Since the intervention group was all male, the women were excluded from the sample, leaving a control group of 23 students. The control group did not show any significant change over the same 3-month period of time on any of the anger



dimensions, thus ruling out the possibility that the drop in anger levels of the test group resulted from the additional 3-month exposure to the presumably less stressful environment of the War College.

Thus these data support the conclusion that individuals who have high levels of anger and low levels of anger control can be effectively trained to reduce their expressions of anger and increase their anger control to the “normal” levels of their peers. Written comments and feedback from program participants also noted a beneficial effect on their experience of stress, as well as a reduction in stress and conflict in their interpersonal relationships both at home and work.

**Summary and Recommendations.** We can conclude that effective psycho-educational programs exist for the modification of anger and hostility. These interventions additionally

produce a beneficial effect on the cardiovascular health of senior military officers, as well as a profound positive impact on their personal and family relationships.

However, one of the most compelling conclusions is that encouraging the outward expression of anger (catharsis) is not effective and, in fact, is probably contraindicated. Instead, the growing body of research clearly suggests that a broad-based, cognitive, behavioral, skill-building approach works best in helping individuals modify their behavior.

## **IMPROVING ORGANIZATIONAL MENTAL HEALTH**

We have seen that convincing connections exist between emotional health and physical health outcomes, and that effective programs are available for reducing toxic feelings such as anger and promoting positive strategies for coping with stress. What actions do these findings imply for senior organizational leaders?

The concept of preventive stress management as it relates to the mental health of workers has been an integral part of industrial psychology since the early part of the 20th century.<sup>28</sup> The two key tenets of preventive stress management are (1) that individual and organizational health are interdependent; and (2) that leaders have a responsibility for individual and organizational health.<sup>29</sup> Today the collected research findings and wisdom from the fields of public health, behavioral medicine, management science, and social and clinical psychology continue to make clear that organizational productivity and morale are dependent on leaders who can help minimize the distress and strain experienced by the individual subordinate within his total environment—the workplace as well as the outside world, including the subordinate's family.<sup>30</sup> We briefly discuss below how executive leaders can begin to take charge of their organization's mental health.

- **Become a Mental Fitness Role Model.** Just as it's important to exemplify good physical health and fitness habits if you expect subordinates to practice them, the same is true for good mental health behaviors. You can hardly demand that your staff members control their anger and handle their frustrations productively if you haven't learned to do so yourself. Also, in order to be a credible advocate for mental health resources both within and outside your organization, it greatly helps if you've taken advantage of and can personally speak about the benefits of such resources.

Whether it means becoming a better manager of our time, stress, anger, anxiety, or depression, we all have some psychological area in which we could stand improvement, just as we have with regard to our physical selves. Finding the right area to focus on necessitates a critical self-examination, either on one's own or with the help of others. Of course, if your organization offers opportunities for such personal reflection and assessment, by all means utilize them. The leaders at the Army War College, for example, are fortunate to have both screening tools and follow-up programs designed for mental health promotion. If your organization doesn't have such programs in-house, check out community, university, or church-related courses and seminars in stress and anger management. You may also wish to talk to a mental health professional such as a psychologist or social worker to find the

program that best fits your needs, just as you would discuss the most appropriate exercise program with your personal fitness trainer.

- **Take Responsibility for Your Subordinates' Mental Health.** Once your own emotional house is in order, you can more effectively address the emotional health of your subordinate leaders and those they lead. Unfortunately, too many leaders are prone to diagnose subordinates' emotional problems and refer them for help (if they do not simply fire or transfer them) without considering their own role in creating and perpetuating the problems.

You should do everything in your power to make certain that resources and programs are in place in your organization or available locally to help the worker whose anger has led to workplace eruptions and family abuse or whose depression has led to drinking, financial, or eating problems. Many staff members could also benefit from your recommendation to attend a stress management course even if symptoms of stress still lie beneath the surface. In addition, however, smart executives will not fail to review their own role in producing stressors in their organizations.

A change in leadership style is often necessary for reducing subordinate stress. The situation may call for a leaderly approach that is more emotionally supportive rather than a no-nonsense task orientation. Or possibly the reverse will be true. Likewise, a staff member's skills and expertise may flourish better when interacting with a laissez-faire leader instead of one who micromanages. Difficulties emerge because leaders, personality-wise, naturally tend to vary in the degree of supervision they exert, their manner of expressing anger control, and the degree of trust they display. The wrong style with the wrong staff members invariably produces stress, which tends to grow more destructive and breed resentment over time.

Although ideally you can achieve a balance of leadership styles that properly suits your staff and its changing situations without losing sight of the bottom line (be it mission or profits), achieving an ideal balance is obviously easier said than done. At a minimum, however, you must read what is going on in the minds of your followers to know if change is needed on your part. Are they angry, bitter, depressed? If so, why? As you move up the ladder, you may find that such feelings become increasingly difficult to detect, both among personal staff members and in subordinate units of your organization. Surface fixes, like throwing office parties or having casual dress days, may only help to address stress symptoms instead of getting to the root of the problem.

Periodic sensing sessions (whether on or off site) which allow staff workers to openly let off steam or speak their minds can be helpful, but many important thoughts and feelings may go unexpressed in such sessions. When trust and communication have deteriorated too far, these sessions may be useless. Similarly, an open door/e-mail policy or the more anonymous suggestion box can provide clues to stress levels in the organization, but these may be unrepresentative of the whole. Better indicators and insight can come from a morale survey, provided, of course, that it is filled out honestly.

If you think that potential complainers fear being ferreted out and made to pay a price, you should call in an organizational consulting or survey agency to do the work. Keep in mind, though, that even outsiders may be distrusted, especially when their methods involve group or individual interviews. On the other hand, if subordinates truly believe that you care about the stress they are experiencing and want to do what you can to alleviate it, they will be grateful for the opportunity to express themselves (which helps relieve some stress in itself). In any case, always report back on the actions you have taken based on such feedback in order to encourage future candid submissions and recommendations.

• **Work to Change the Organizational Culture and Buffer the Environment within the Limits of Your Power.** It is important for your subordinates to understand what things you can and cannot control in the workplace. Whether it involves working conditions, pay, benefits, quotas, time off, deadlines, or quality control standards, some factors that influence worker morale and mental health lie outside your direct ability to change. The good news is that your subordinates don't expect you to exercise godlike powers to magically create the perfect work environment. However, they do expect and appreciate knowing why things are the way they are and what the possibilities may be for change in the future. Be honest about whatever the problem or hang-up might be—market conditions, competition, senior staff politics, laws, or regulations—since you'll have a potentially far worse situation if and when a "cover-up" is discovered. For example, a loss of organizational trust is practically inevitable if employees are told that there will be no Christmas bonuses due to budget cuts and profit squeezes, only later to learn about increases in senior executive pay packages.

Most importantly, subordinates need to know that you'll go to bat for them in making sure their interests get a fair hearing. They might understand that senior pay packages need to be increased to attract top talent for a revitalization of the organization, but they'll feel better about you if they know that you've stood up and voiced their concern that Christmas bonuses are a critical component of their budgets and that some compromise, perhaps stock options or a reasonable one-time reduction, is preferable to outright elimination. It clearly takes courage to stand up to threatening forces from without. While it is obviously not advisable to fall on your sword on a regular basis, carefully choosing battles that will demonstrate that you are not *solely* motivated by your own career advancement will pay handsome dividends in trust, confidence, loyalty, and respect. Never be afraid to say, "I don't know" or "I've done all I can" or even "I made a mistake." Remember that your subordinates don't expect you to be superhuman, just considerate enough of them to tell it like it is. This does not mean that you should alert them to every possible environmental threat and fill them in on the details of senior staff gossip. Part of your job is acting as a buffer against things that would needlessly concern workers and which you can handle efficiently at your level.

Times of great organizational change due to new programs and policies, downsizing, or shifts in culture pose special leadership challenges. The ability to guide your organization through new ways of doing business that might be at serious odds with entrenched routines demands wisdom and perseverance, but may often be the key to long-term organizational survival and success. Racial integration and equal opportunity are generally considered relative success stories in the U.S. Army, but they were accomplished only through unsung

leaders daily modeling and enforcing new standards of behavior. The Army, like the rest of government and corporate America, still has a ways to go in improving gender equality and reducing the incidence of sexual harassment. Again, achieving the latter will ultimately occur only if each individual leader stops tolerating unacceptable behavior in his or her organizational sector. The very best leaders, by the way, are not those who successfully carry out a difficult, but critically essential policy change, but rather those who have the vision and concern for organizational health to voice a need for the change in the first place.

A final note relates to the necessity for leaders who seek to optimize the mental health and productivity of their followers to take into account the interface of work and family. With both parents working in most families, it is a greater challenge than in the past to juggle and balance work and home life. Since job productivity, motivation, and the ability to concentrate are very much tied to how things are going at home, the leader who is also the preventive stress manager will take steps to ensure that the organization has done all that it can to accommodate and support family needs. These steps may include reviewing flextime, work-at-home and family leave policies, child and elder day opportunities, health insurance benefits, and counseling or other support mechanisms. As the military has discovered, these support systems are especially crucial when subordinates are separated from their families for significant periods of time. It takes a leader with insightful skills, not merely empathy, to factor in the need to take care of families without compromising the organizational mission.

Why bother spending time and money on mental health concerns? For the same preventive health reasons that lead you to encourage your workforce to get flu shots, stop smoking, exercise regularly, have annual medical checkups, drive safely, drink only in moderation, eat right, and lose excess weight. Not only do you care about their mental health and fitness as fellow human beings, but you understand that absenteeism, low productivity, and poor performance are just as likely to result from a mental as from a physical ailment. In fact, doctors often find that emotional stress problems underlie physical symptoms. Without that ounce of prevention on the psychological front, we should not be surprised by the often violent results of unchecked anger and depression in the workplace.

In a tight labor market with low unemployment, leaders can hardly afford to burn out workers, especially their best performers. Sadly, many executives do not learn this lesson until it's too late. The emotional health and morale of an organization require the joint efforts of both subordinates and leaders. Keeping a challenged organization from sliding into a distressed one may well be the hallmark of a truly great leader.

## **CONCLUDING THOUGHTS**

Earlier this century it was said that ours was the Age of Anxiety. Given the Holocaust and the ethnic hatreds and "cleansings" that have occurred in Africa and Europe towards the close of the last century, our new century is probably best characterized as the Age of Anger. Perhaps the most important task facing mankind as it enters the 2000s is to cope successfully with our individual anger and hostility.

It needs to be emphasized that the goal of the various anger control strategies that have been developed by psychologists is precisely that, the *control* of anger, not its elimination. If anger is an evolved biological response to pain, frustration, and situations that present a threat to one's existence, then it is unlikely that anger can or should ever be completely eliminated. Provocations, frustrations, pain, and illness are part of the human condition. The purpose of anger-intervention strategies is to *control* anger so that we do not become consumed by it, to free up energies so that we can lead more productive, more creative, and more socially useful lives. Moreover, it is not at all clear that the total elimination of anger is a desirable goal, even if such total elimination could be achieved. Some measure of controlled anger can be a good thing if it motivates us to fight evil and injustice.

## ENDNOTES

1. B. Bell, C. L. Rose, and A. Damon, "The Normative Aging Study: An Interdisciplinary and Longitudinal Study of Health and Aging," *International Journal of Aging and Human Development*, Vol. 3, 1972, pp. 3, 5-17.
2. Ray H. Rosenman, "Relationship of the Type A Behavior Pattern with Coronary Heart Disease," *Handbook of Stress*, eds. L. Goldberger and S. Breznitz, New York: The Free Press, 1983, pp. 449-476; Meyer Friedman and Ray H. Rosenman, *Type A Behavior and Your Heart*, New York: Fawcett Crest, 1974.
3. R. B. Shekelle et al., "The MRFIT Behavior Pattern Study: II. Type A Behavior Pattern and Evidence of Coronary Heart Disease," *American Journal of Epidemiology*, Vol. 122, 1985, pp. 559-570.
4. M.A. Mittleman et al., "Triggering of Acute Myocardial Infarction Onset by Episodes of Anger," *Circulation*, Vol. 92, 1995, pp. 1720-1726.
5. I. Kawachi et al., "A Prospective Study of Anger and Coronary Heart Disease: The Normative Aging Study," *Circulation*, Vol. 94, 1996, pp. 2090-2095; and Aron W. Siegman et al., "The AHA Syndrome and Coronary Heart Disease: The Normative Aging Study," Symposium paper delivered at the 20<sup>th</sup> International Conference of the Stress and Anxiety Research Society, Krakow, Poland, July 1999.
6. Aron W. Siegman et al., "Dimensions of Anger and CHD in Men and Women: Self-ratings Versus Spouse-ratings," *Journal of Behavioral Medicine*, Vol. 21, 1998, pp. 315-336. For STAXI, consult C. D. Spielberger, E. C. Reheiser, and S. J. Sydeman, "Measuring the Experience, Expression, and Control of Anger," in *Anger Disorders: Definitions, Diagnosis, and Treatment*, ed. H. Kassinove, Washington, DC: Taylor and Francis, 1995.
7. Aron W. Siegman and S. Cappel-Snow, "The Outward Expression of Anger, the Inward Expression of Anger, and CVR," *Journal of Behavioral Medicine*, Vol. 20, 1997, pp. 29-45; and S. Cappel-Snow, "Cardiovascular Reactivity During Anger Arousing and Neutral Situations: An Experimental Investigation of the Experience of Anger and the Expression of Anger," Ph.D. dissertation, University of Maryland, Baltimore County, 1998.
8. E. C. Suarez, M. P. Bates, and T. L. Harrison, "The Relation of Hostility to Lipids and Lipoproteins in Women: Evidence for the Role of Antagonistic Hostility," *Annals of Behavioral Medicine*, Vol. 14, No. 6, 1991, pp. 555-565.
9. Aron W. Siegman et al., "Lipid Concentrations and Glucose Levels: Relationships with Anger Expression and Physical Fitness," Poster paper presented at Fifth International Congress of Behavioral Medicine, Copenhagen, Denmark, August 19-22, 1998.

10. M. M. Muller et al., "The Relationship Between Habitual Anger Coping Style and Serum Lipid and Lipoprotein Concentrations," *Biological Psychology*, Vol. 41, 1995, pp. 69–81.
11. V. F. Dujovne and B. K. Houston, "Hostility-related Variables and Plasma Lipid Levels," *Journal of Behavioral Medicine*, Vol. 14, No. 6, 1991, pp. 555–565.
12. M.W. Keterer et al., "Denial of Depression As an Independent Correlate of Coronary Artery Disease," *Journal of Health Psychology*, Vol. 1, 1996, pp. 93-105; M. H. Keterer et al., "Five Year Follow-up for Adverse Outcomes in Males With at Least Minimally Positive Angiograms: Importance of Denial in Assessing Psychosocial Risk Factors," *Journal of Psychometric Research*, Vol. 44, 1998, pp. 241-250; and Aron W. Siegman and S. Boyle, "Anger Repression and Cardiovascular Reactivity," Paper presented at Third International Congress of Behavioral Medicine, Amsterdam, The Netherlands, August 1994.
13. E. I. Megargee, "Undercontrolled and Overcontrolled Personality Types in Extreme Antisocial Aggression," *Psychological Monographs*, Vol. 80, 1966, p. 611.
14. I. Karochi et al., "Symptoms of Anxiety and Risk of Coronary Heart Disease: The Normative Aging Study," *Circulation*, Vol. 90, 1994, pp. 2225-2229; L. D. Kubzansky et al., "Is Worrying Bad for Your Heart? A Prospective Study of Worry and Coronary Heart Disease in the Normative Aging Study," *Circulation*, Vol. 95, 1997, pp. 818-824; L. D. Kubzansky et al., "Anxiety and Coronary Heart Disease: A Synthesis of Epidemiological, Psychological, and Experimental Evidence," *Annals of Behavioral Medicine*, Vol. 20, No. 2, 1998, pp. 1-13; and A.W. Siegman et al., "The AHA Syndrome and Coronary Heart Disease: The Normative Aging Study."
15. A. Razanski et al., "Impact of Psychological Factors on the Pathogenesis of Cardiovascular Disease and Complications for Therapy," *Circulation*, Vol. 99, 1999, pp. 2192-2217.
16. H. D. Sesso et al., "Depression and the Risk of Coronary Heart Disease in the Normative Aging Study," *American Journal of Cardiology*, Vol. 82, 1998, pp. 851-856.
17. N. Frasure-Smith, R. Lesperance, and M. Talajic, "Depression Following Myocardial Infarction: Impact on 6-Month Survival," *Journal of the American Medical Association*, Vol. 270, 1993, pp. 1819-1825.
18. Aron W. Siegman et al., "A Prospective Study of Dominance and Coronary Heart Disease in the Normative Aging Study," *American Journal of Cardiology*, Vol. 86, 2000, pp. 145-149.
19. Aron W. Siegman et al. "Antagonistic Behavior, Dominance, Hostility, and Coronary Heart Disease," *Psychosomatic Medicine*, Vol. 62, 2000, pp. 248-257; Aron W. Siegman et al., "Expressive Vocal Behavior and the Severity of Coronary Artery Disease," *Psychosomatic Medicine*, Vol. 49, 1987, pp. 295-302; and Aron W. Siegman, "Cardiovascular Consequences of Expressing, Experiencing, and Repressing Anger," *Journal of Behavioral Medicine*, Vol. 16, 1993, pp. 539-569.
20. J. R. Kaplan et al., "Social Status Environment and Atherosclerosis in Cynomolgous Monkeys," *Atherosclerosis*, Vol. 2, 1982, pp. 359-368; and J. R. Kaplan et al., "Inhibition of Coronary Atherosclerosis by Propranolol in Behaviorally Predisposed Monkeys Fed an Atherogenic Diet," *Circulation*, Vol. 76, 1987, pp. 1365-1372.
21. R. W. Novaco, *Anger Control: The Development and Evaluation of an Experimental Treatment*, Lexington, MA: Heath, 1975. See also D. Meichenbaum and R. W. Novaco, "Stress Inoculation: A Preventative Approach," in *Stress and Anxiety*, Vol. 5, New York: Halstead Press, 1977.
22. D. Meichenbaum, *Stress Inoculation Training: A Practitioner's Guidebook*, New York: Allyn & Bacon, 1985.
23. R. M. Suinn, *Anxiety Management Training*, New York: Plenum, 1990.

24. R. C. Tafrate, "Evaluation of Treatment Strategies for Adult Anger Disorders," in *Anger Disorders*, ed. H. Kassirer, Washington, DC: Taylor & Francis, 1995.
25. J. L. Deffenbacher, "Anger Reduction: Issues, Assessment, and Intervention Strategies," in *Anger, Hostility, and the Heart*, eds. Aron W. Siegman and T. Smith, Hillsdale, NJ: Erlbaum Associates, 1993; and J. L. Deffenbacher, "Ideal Treatment Package for Adults with Anger Disorders," in *Anger Disorders*, ed. H. Kassirer, Washington, DC: Taylor & Francis, 1995.
26. Meyer Friedman et al., "Alteration of Type A Behavior and Reduction in Cardiac Recurrences in Postmyocardial Infarction Patients," *American Heart Journal*, Vol. 108, 1984, pp. 237-249; and J. J. Gill et al., "Reduction in Type A Behavior in Healthy Middle-aged American Military Officers," *American Heart Journal*, Vol. 110, 1985, pp. 503-514.
27. Redford Williams and Virginia Williams, *Anger Kills: Seventeen Strategies for Controlling the Hostility That Can Harm Your Health*, New York: Random House, 1993; and Virginia Williams and Redford Williams, *LifeSkills*, New York: Random House, 1997.
28. D. A. Laird, *Psychology and Profits*, New York: B. C. Forbes, 1929; and H. B. Elkind, ed., *Preventive Management: Mental Hygiene in Industry*, New York: B. C. Forbes, 1931.
29. J. C. Quick, "Occupational Health Psychology: The Convergence of Health and Clinical Psychology with Public Organizational Context," *Professional Psychology: Research and Practice*, Vol. 30, No. 2, 1999, pp. 123-128.
30. J. A. Adkins, "Promoting Organizational Health: The Evolving Practice of Occupational Health Psychology," *Professional Psychology: Research and Practice*, Vol. 30, No. 2, 1999, pp. 129-137.



APPENDIX 1.  
Sample MMPI-2 Anger Markers

1. At times I feel like swearing.
2. At times I feel like smashing things.
3. I have very few quarrels with members of my family.
4. Sometimes when I am not feeling well I am irritable.
5. Often I can't understand why I have been so irritable and grouchy.
6. It makes me impatient to have people ask my advice or otherwise interrupt me when I am working on something important.
7. I get mad easily and then get over it soon.
8. I easily become impatient with people.
9. I am not easily angered.
10. I get angry when my friends or family give me advice on how to live my life.
11. I am often said to be hotheaded.
12. I am often sorry because I am so irritable and grouchy.
13. I often become very irritable when people interrupt my work.
14. Sometimes I get so angry and upset I don't know what comes over me.
15. I have become so angry with someone that I have felt as if I would explode.
16. I almost never lose self-control.

APPENDIX 2.  
MMPI-2 Factor Analytically Derived Impatience-Irritability Scale

1. Sometimes when I'm not feeling well I am irritable.
2. Often I can't understand why I have been so irritable and grouchy.
3. It makes me impatient to have people ask my advice or otherwise interrupt me when I am working on something important.
4. I resent having anyone trick me so cleverly that I have to admit I was fooled.
5. I easily become impatient with people.
6. I get angry when my friends or family give me advice on how to live my life.
7. It makes me angry to have people hurry me.
8. I often become very irritable when people interrupt my work.
9. At movies, restaurants, or sporting events, I hate to have to stand in line.
10. I get very irritable when people I depend on don't get their work done in time.

APPENDIX 3.  
Sample Markers for Physiological Anxiety, Cognitive Anxiety, and Low  
Self-Esteem.

**Physiological Anxiety**

1. My hands and feet are usually cold.
2. My sleep is fitful and disturbed.
3. I tire quickly.
4. Sometimes, when embarrassed, I break out in a sweat, which annoys me greatly.
5. I frequently notice my heart pounding and am frequently short of breath.

**Cognitive Anxiety**

1. I frequently find myself worrying about something.
2. I worry over money and business.
3. I cannot keep my mind on one thing.
4. I have sometimes felt that difficulties were piling so high that I could not overcome them.
5. I worry quite a bit over possible misfortunes.

**Low Self-Esteem**

1. I am certainly lacking in self-esteem.
2. I certainly feel useless at times.
3. I am entirely lacking in confidence.
4. I am easily embarrassed.
5. I shrink from facing a crisis or difficulty.

APPENDIX 4.  
MMPI-2 Factor Analytically Derived Dominance Scale

1. When people do me a wrong, I feel I should pay them back if I can, just for the principle of the thing.
2. I frequently find it necessary to stand up for what I think is right.
3. I have at time stood in the way of people who were trying to do something, not because it amounted to much, but because of the principle of the thing.
4. I like to let people know where I stand on things.
5. I am so often annoyed when someone tries to get ahead of me in a line of people, that I speak to that person about it.
6. I have often times had to be rough with people who were rude or annoying.
7. I am often inclined to go out of my way to win a point with someone who has opposed me.
8. I am usually very direct with people I am trying to correct or improve.
9. I do not try to cover up my poor opinion or pity of people so that they won't know how I feel.
10. I strongly defend my opinion as a rule.
11. When people do something that makes me angry, I let them know how I feel about it.
12. I like to drive a hard bargain.
13. I like making decisions and assigning jobs to others.

## CHAPTER 6

# THE ROLE OF SLEEP IN SUSTAINING INDIVIDUAL AND ORGANIZATIONAL EFFECTIVENESS

Nancy J. Wessensten, Thomas J. Balkin, and Gregory Belenky

Sleep is critical to sustaining operational performance. From a managerial point of view, sleep can be viewed as a logistical item, similar to water, food, fuel, ammunition, and computer resources. Skillful leaders will plan proactively for adequate resupply of sleep for themselves and their subordinates.

This chapter describes the contribution of sleep and time of day (circadian rhythms) to individual and organizational effectiveness. We use the term "organization" to mean any group organized to pursue a concrete objective, whether military or civilian. In the first section we present an overview of sleep deprivation effects on those cognitive or mental functions relevant to organizational effectiveness. Next, we discuss how travel across time zones and shift work impair sleep. Finally, we present solutions to the problem of sleep deprivation effects on organizational operations.<sup>1</sup>

### CASE HISTORIES

How does sleep sustain operational performance? No one can dispute that falling asleep while on duty in an operational setting can lead to error, accident, and even catastrophe. What is less well understood is that sleep deprivation systematically degrades performance long before people become so sleepy that they fall asleep while working (e.g. driving an automobile, truck, etc.) In particular, sleep-deprived people will persevere, repeatedly attempting to implement failed solutions. Such sleep deprivation can have devastating effects on individual and organizational performance and effectiveness even while the persons involved are awake. Cases abound. For example, the Chernobyl nuclear reactor meltdown, the Exxon Valdez oil spill, the Challenger space shuttle disaster, and a tragic Gulf War friendly fire episode can all be partly linked to decisions made by people apparently awake but nonetheless suffering from a severe lack of sleep.

Let's look at the Challenger episode and the friendly fire incident in a little more detail.

### Challenger Disaster

The U.S. Space Shuttle Challenger exploded on January 28, 1986, 73 seconds into its tenth flight, killing all seven crew members, including a civilian schoolteacher, Christa McAuliffe. From an engineering standpoint, the disaster was caused by the failure of an "O" ring in one of the solid rocket boosters to properly seat on ignition. The "O" ring lost flexibility because of

the cold temperatures on the day of the launch. The failure to accurately evaluate the reliability of the "O" rings under prevailing weather conditions has been attributed to insufficient sleep on the part of NASA managers involved in the launch decision. Of the three high-level NASA managers involved, two had had less than 3 hours of sleep for 3 consecutive nights prior to the launch.<sup>2</sup>

## **Gulf War Friendly Fire Incident**

This case history from the Gulf War illustrates sleep deprivation and time-of-day or circadian effects on organizational performance during military operations. During a night of total sleep deprivation, at approximately 0100 hours on February 26, 1991, a Second Armored Cavalry Regiment Bradley platoon screen line observed hot spots approaching on their thermal sights. They were uncertain as to whether these were friend or foe, and continued to observe. It was not until the lead vehicle actually entered their screen line that the Bradley crews concluded that the hot spots were a column of Iraqi armored personnel carriers. A brief firefight ensued, during which all the Iraqi vehicles were destroyed. However, during the firefight, the two Bradleys at the screen line right flank turned left and faced down their own line, but thought they were still facing the enemy. Perceiving that two Bradleys on the left flank were enemy vehicles, they proceeded to enfilade their own line with fire, destroying the two Bradleys on the left flank.

One of the authors of this chapter led the mental health team attached to the Second Armored Cavalry Regiment and thus was able to reconstruct the friendly fire incident shortly after the event with all crew members present.<sup>3</sup> By their own self-report, the Bradley crews had obtained only 3-4 hours of sleep per night over the previous 5 days, and the firefight ensued during the early morning hours. Thus the crews were sleep-deprived and operating at a time of day when complex mental operations are at their worst. Despite this, the crew was still able to put the cross-hairs on the target and fire rounds accurately down-range—as evidenced by the destruction of the Bradleys on the left flank. Their *disorientation from the front* was the cause of this unfortunate friendly fire incident, because the crew was operating under the axiom that "if it's in front of us, it dies."

## **ORGANIZATIONAL AND MILITARY EFFECTIVENESS**

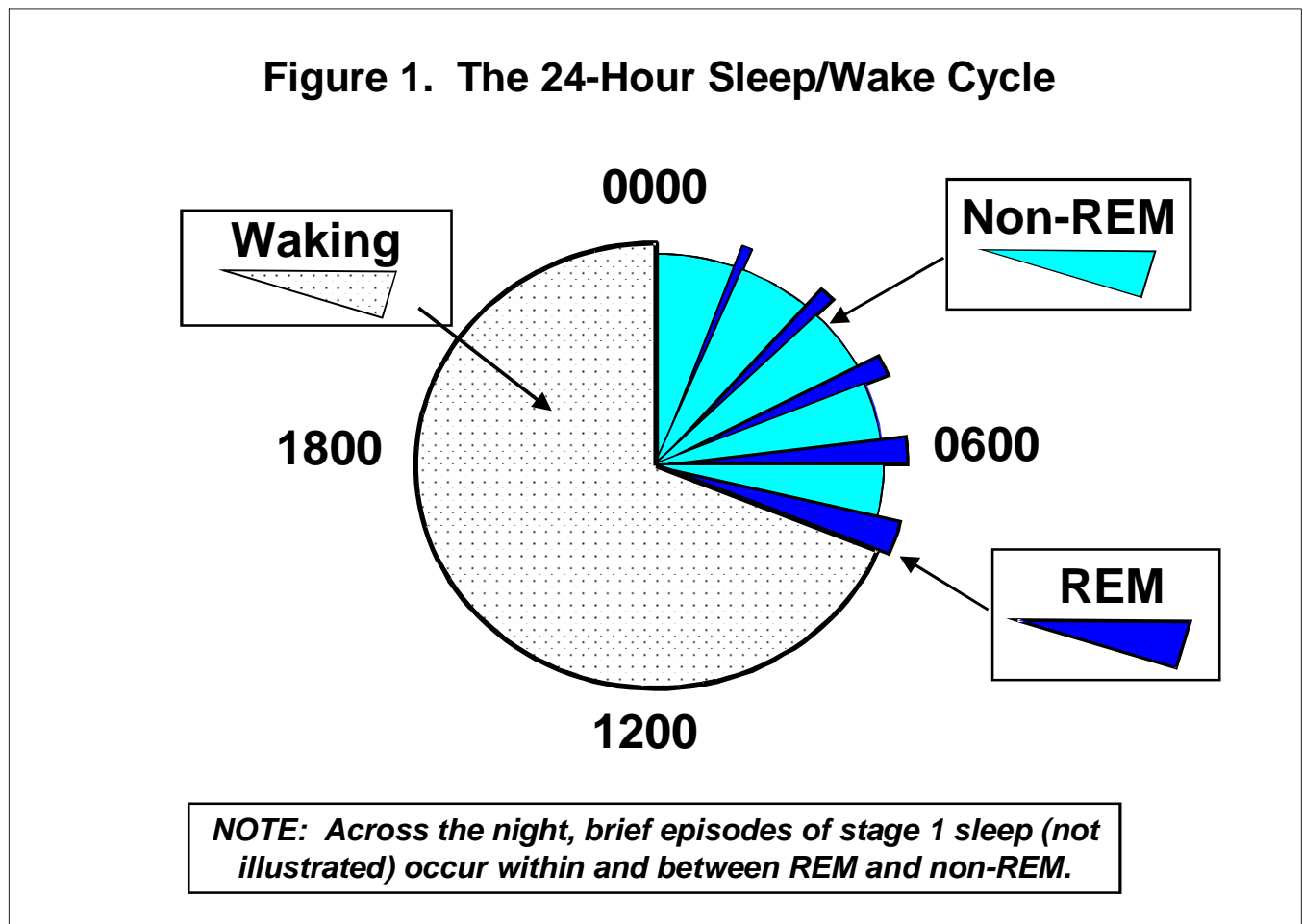
The case histories above illustrate that even as computer systems, weaponry, and organizations in general become more sophisticated, the individual and his or her performance remain critical to the success of organizational operations, both military and civilian. In its most basic form, effectiveness in any operational environment depends upon the person making the correct decision within a limited time.

Factors known to shape operational effectiveness, at both the individual and group or unit level, include experience, training, fitness, morale, leadership, cohesion, personal and family considerations, and such physiological factors as load, hydration, nutritional status, and sleep. We are just beginning to appreciate the impact of sleep on individual and

organizational effectiveness. The two case histories bore all the marks of the effects of sleep deprivation on mental performance.

## SLEEP--THE BASICS

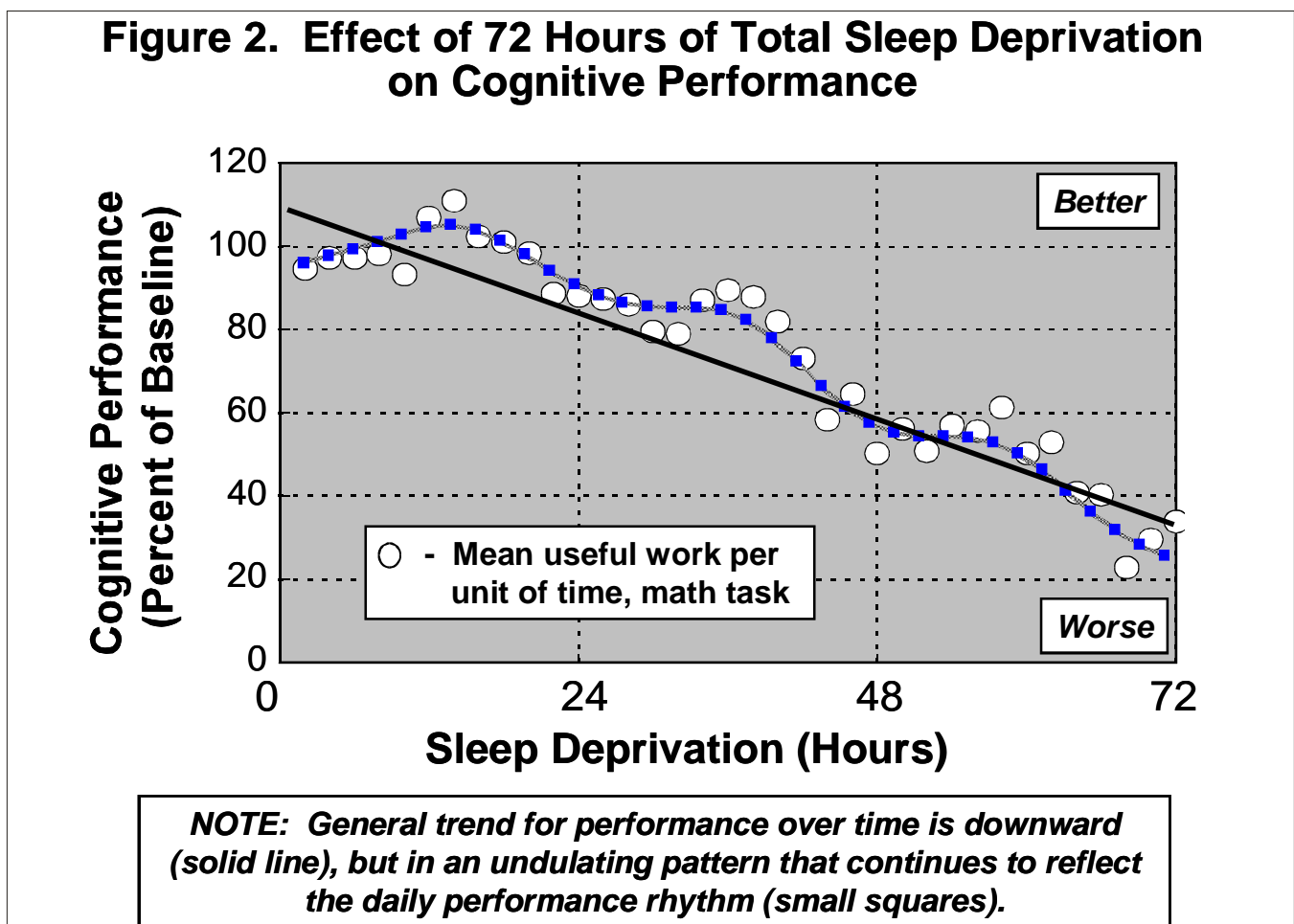
Figure 1 depicts the 24-hour sleep-wake cycle in a person who sleeps from midnight to 0800, which is the daily amount considered optimal for sustaining maximal mental performance indefinitely. Stage 1 sleep, the lightest sleep stage, has little or no value for sustaining mental operations. During the primary sleep period, sleep stages alternate between REM (rapid eye movement) and non-REM sleep. In ways that we are now just beginning to understand, this combination of REM and non-REM sleep sustains complex mental operations during the ensuing period of wakefulness. Currently there is no evidence that recuperation after REM sleep differs from that after non-REM.



# EFFECTS OF SLEEP DEPRIVATION ON COMPLEX MENTAL OPERATIONS

## Total Sleep Deprivation

Total sleep deprivation exerts substantial deleterious effects on those complex mental operations (cognitive performance) critical to organizational effectiveness. Figure 2 shows that cognitive performance on a task requiring decisionmaking, short-term memory, and mathematical processing declines by about 25% for every 24 hours of wakefulness. This means that after 72 hours of total sleep deprivation, complex mental performance has degraded by 75%.



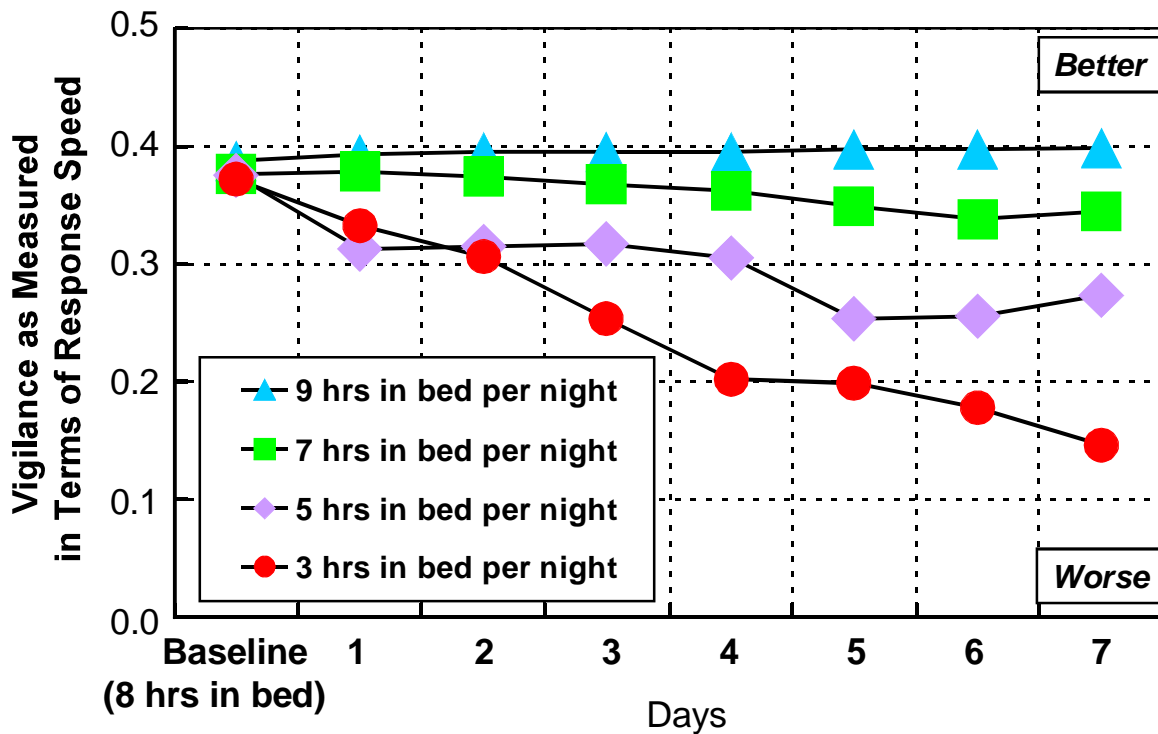
## Partial Sleep Deprivation (Restricted Sleep)

If 8 hours of sleep per day sustains maximal mental performance indefinitely, can we get by with less than 8 hours of sleep per day? The answer is that we can, but we will pay a performance penalty for it. Figure 3 shows mental performance over a week for various nightly sleep schedules. Nine hours in bed per night sustains performance. In contrast, 3



hours in bed per night results in immediate and devastating performance deficits that continue to mount over succeeding nights. After a week, performance is reduced by 70% compared to the levels maintained by the group allowed 9 hours in bed per night. Intermediate amounts of sleep (3 hours; 5 hours; 7 hours) also fail to sustain performance. In sum, short-changing sleep decreases productivity.

**Figure 3. Seven Days of Restricted Sleep: Effects on Vigilance**



### Disrupted (Disturbed) Sleep

If an individual spends 8-9 hours in bed per night, but during this time sleep is disrupted or fragmented due to noise or attempting to sleep during daytime hours, mental performance and alertness are impaired. The more frequently that sleep is disrupted, the more difficult it is to maintain next-day alertness and mental performance. Disrupting sleep obviously increases wake time, decreasing total sleep time, but it also increases the amount of less useful stage 1 sleep. Because stage 1 has little or no value for sustaining mental operations, disrupted sleep decreases recuperative sleep time, just the same as restricted sleep or total sleep deprivation.

## **Summary--Sleep Deprivation Effects**

Although total sleep deprivation clearly impairs mental operations, restricting or disrupting sleep also impairs mental operations. In short, whenever recuperative sleep time is reduced, mental operations are impaired—whether owing to total sleep deprivation, partial sleep deprivation, or the far less obvious situation in which sleep is disrupted or fragmented.

Sleep deprivation exerts two main behavioral effects. First, it makes the individual more susceptible to falling asleep in a boring or non-stimulating environment—for example, while performing a monotonous task or watching television. Second, even in a stimulating environment where the susceptibility to falling asleep is minimal, sleep deprivation directly impairs higher order mental operations. Tasks most susceptible to the harmful effects of sleep deprivation are those that are tenuously learned, are multifaceted, or require an imaginative solution. The case histories discussed earlier provide excellent examples of these types of tasks.

Can an accurate self-estimate of performance in the face of sleep deprivation be obtained from individuals? The answer is no. Sleep-deprived individuals are themselves poor judges of their own cognitive performance—this is perhaps not surprising since those areas of the brain involved in self-assessment are impaired by sleep deprivation (discussed below).

## **EFFECTS OF SLEEP DEPRIVATION ON REGIONAL BRAIN**

Results of brain imaging (positron emission tomography or PET) studies during sleep deprivation have revealed that sleep deprivation decreases brain activation. More critical is that activation is most decreased in specific brain areas—those mediating the ability to maintain alertness and vigilance and those mediating higher order mental operations such as situational awareness, adaptability, mental agility, judgment, initiative, anticipation, and planning. These qualities are crucial for organizational effectiveness. During sleep itself, those brain regions most affected by sleep deprivation are also deactivated to the greatest extent. Thus, the primary function of sleep may be to restore and sustain brain regions that (1) mediate the ability to maintain wakefulness under non-stimulating conditions, and (2) mediate higher order mental operations. Results of the brain imaging studies are consistent with previously established performance effects of sleep deprivation.

## **Consequences for Job Performance**

As indicated earlier, sleep deprivation exerts two main effects: it decreases the ability to resist sleep under boring, repetitive, and non-stimulating circumstances; and it also directly impairs mental performance even in a stimulating environment. Thus whether a job is likely to be affected by sleep deprivation depends on the extent to which it involves these components. Examples of tasks that are likely to be very sensitive to sleep deprivation include manning a tactical screening position during hours of darkness, monitoring data

displays for critical levels, monitoring output for quality control purposes, and sentry or patrol duties.

On the surface, all of these tasks appear to be relatively simple, easily learned, and thus resistant to sleep deprivation. However, these tasks require all of the mental processes most affected by sleep deprivation. First, all embody conditions that increase the likelihood of falling asleep. They are generally long-duration tasks that are very infrequently punctuated with arresting events, and therefore present very little mental or physical stimulation. Second, should a critical event occur, these tasks then involve complex mental operations. As an example, manning a screening position calls for discriminating friend from foe followed by decisionmaking: Destroy the foe? Take action to restore levels to non-critical values? Pull the unacceptable output off the line?

What about individuals at higher organizational levels (e.g. command and control)? Even if they are sleep-deprived, they are not likely to fall asleep in a high op-tempo environment, for example, the commander in the tactical operations center or the executive in a high-pressure meeting with the CEO. Nonetheless, their decisionmaking skills are impaired, and they will be less likely to generate novel solutions to problems. Instead, they are likely to continue tried and true solutions even in the face of evidence that these solutions are not working. They also will be less likely to keep up with continuously evolving situations and make sense of and integrate newly emerging information. They may simply ignore or downplay conflicting information.

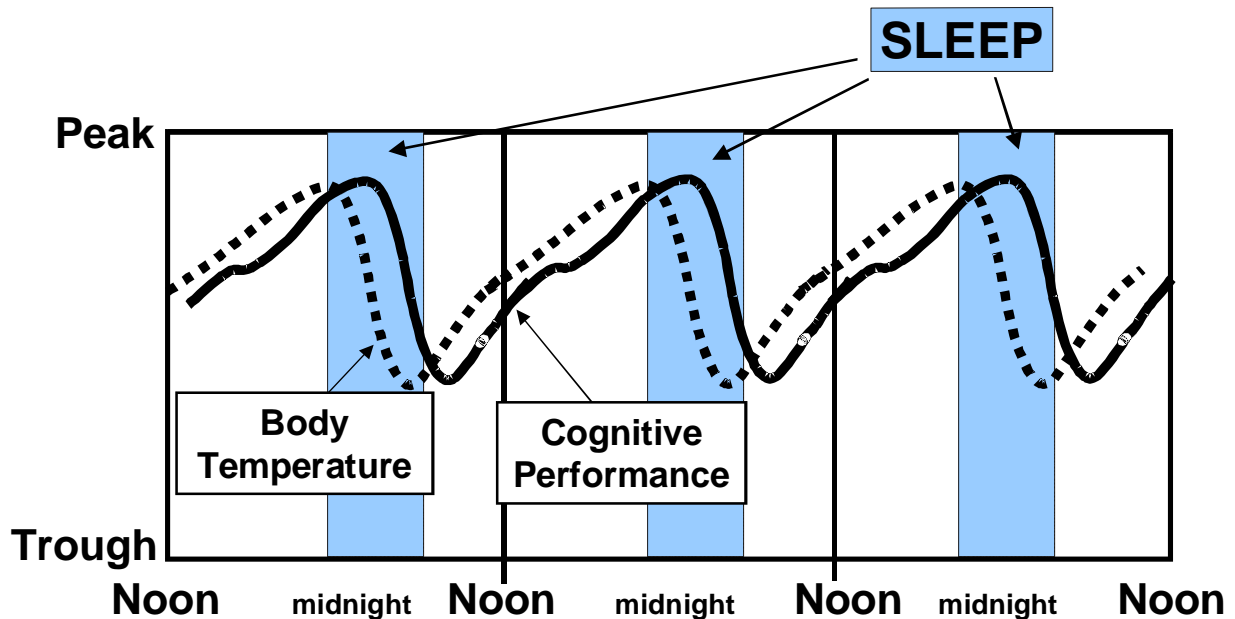
## **TIME-OF-DAY (CIRCADIAN) EFFECTS ON PERFORMANCE AND SLEEP**

Independent of an individual's sleep history, time-of-day (or circadian phase) affects cognitive performance, alertness, and many physiological variables. Figure 4 illustrates the usual relationships among body temperature, complex mental operations, and sleep. Peaks and troughs in body temperature slightly precede those of cognitive performance. Sleep generally occurs across the lowest points in body temperature and cognitive performance.

### **Complex Mental Operations**

The circadian rhythm for cognitive performance (Figure 4) is similar to the rhythm for body temperature, peaking during the period 10:00 p.m. to midnight, and entering a trough at approximately 6:00 a.m. to 10:00 a.m. A slight decrement in alertness and complex mental operations in the early to mid-afternoon hours (1:00 p.m. to 3:00 p.m.) also occurs, although the overall trend across the day is toward improved performance. The daily rhythm in complex mental operations is maintained during sleep deprivation, as is body temperature rhythm, and may vary within a single day by 20% (peak to trough). In short, independent of the amount of sleep, time of day strongly influences complex mental operations.

**Figure 4. Relationships among Sleep, Body Temperature, and Cognitive Performance**



### Sleep Tendencies

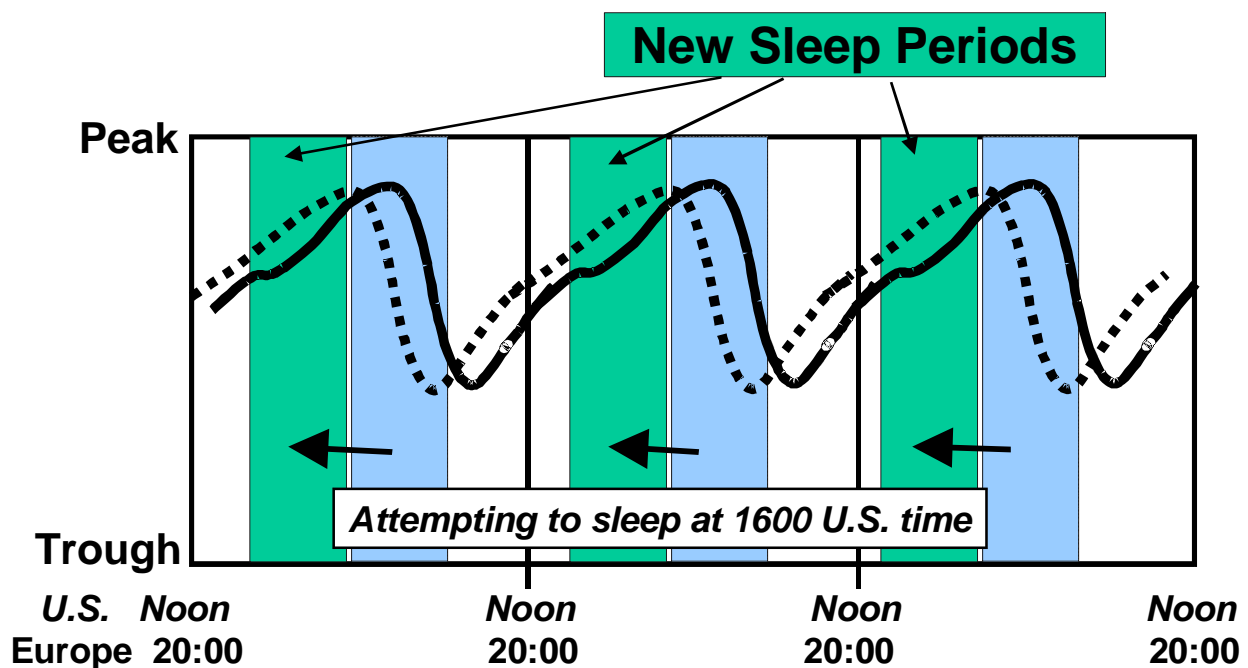
The propensity to sleep is highest just after the late evening peak in body temperature, and this is when most individuals initiate sleep (Figure 4, gray bars). Thus the bulk of sleep generally accrues during the subsequent minimums in both body temperature and mental performance rhythms. Sleep is typically terminated in the early morning hours, as body temperature begins to rise. For reasons not yet understood, individuals are more likely to fall asleep and remain asleep during the period when body temperature is at its lowest.

### Time Zone Shifts

Travel between time zones and shift work result in a realignment of sleep, body temperature, and cognitive performance rhythms. In the example depicted in Figure 5, showing eastward travel from the United States to Europe, the new sleep period (cross-hatched bars) falls across the ascending limb of the body temperature rhythm, overlapping with peak body temperature. Sleep during this body temperature phase is characterized by frequent awakenings and nonrecuperative stage 1 sleep. Consequently, the individual is partially sleep deprived (possibly the underlying cause of jet lag). Also, the

desired period of wakefulness (i.e., the workday in the new time zone) occurs when circadian rhythms dictate that cognitive performance is at its worst. These effects occur in addition to direct effects of partial sleep deprivation on mental operations. West-bound travel results in similar problems, and adaptation and resynchronization of cognitive performance and alertness rhythms to a new time zone can take several days.

**Figure 5. Relationships among Sleep, Body Temperature, and Cognitive Performance following an 8-hour time zone advance (U.S. to Europe)**

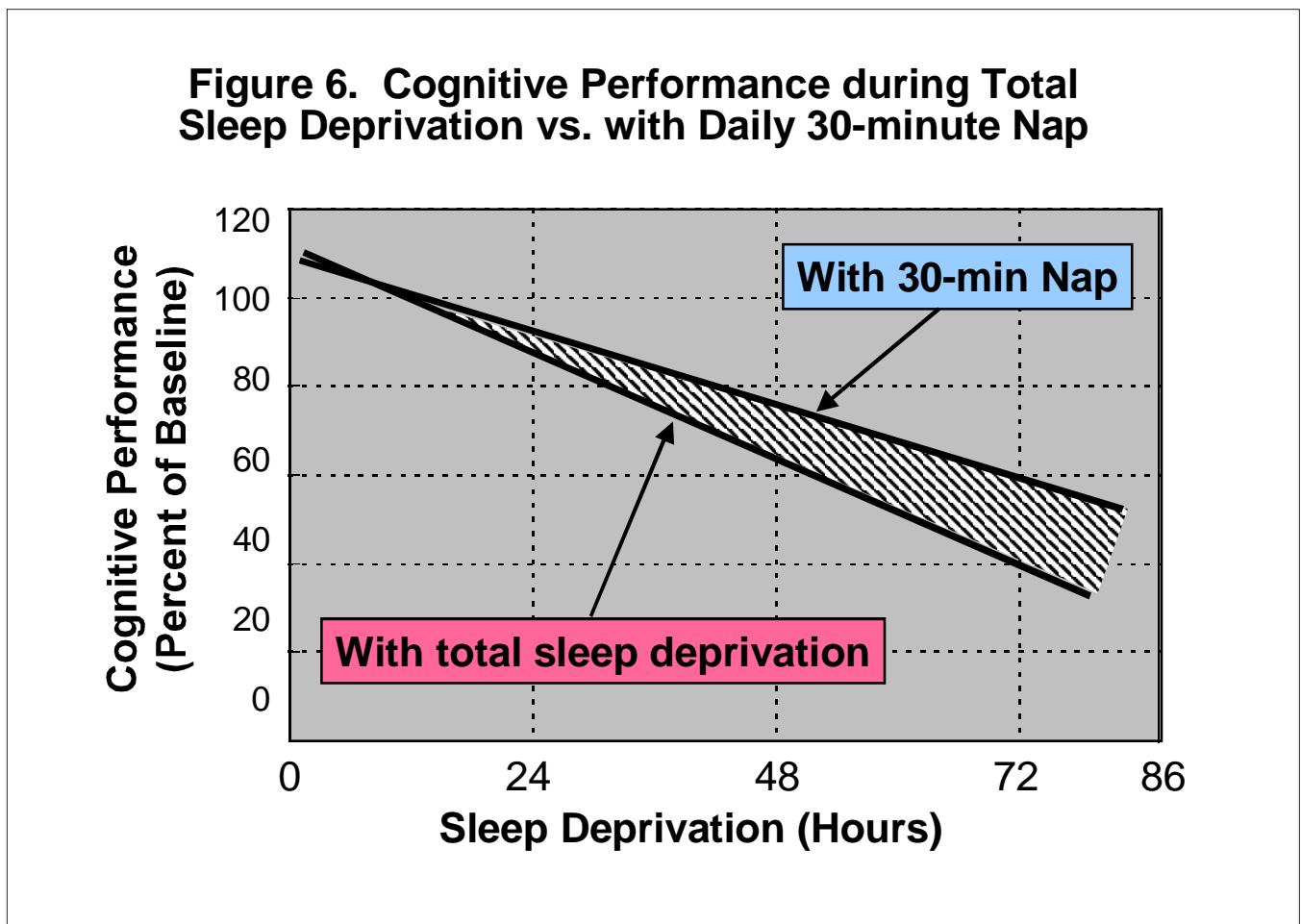


Scientific literature and the popular press are filled with strategies for “shifting circadian rhythms,” although it is often unclear which “rhythm” is to be shifted. Some of these shift strategies are discussed below, e.g., melatonin administration. In some cases they have been known to improve *subjective* feelings (e.g., feelings of fatigue and nausea), but none have been shown to improve *objectively measured* mental operations. On the other hand, evidence is overwhelming that improving and increasing sleep time has objective, positive effects on mental operations. The strategies discussed below include both non-pharmacological and pharmacological approaches to improving sleep when persons are required to sleep at odd times or under non-sleep-conducive conditions. Also discussed are means for improving alertness and performance on a short-term basis when sleep is impossible.

## TAKING NAPS: A NON-PHARMACOLOGICAL MEANS FOR INCREASING OR IMPROVING SLEEP

The term nap generally refers to any sleep period outside of the main sleep period. Napping can constitute an excellent strategy for increasing total daily sleep time, so long as the individual actually *sleeps* during the napping period. Substantial benefit is derived from even small amounts of sleep. Figure 6 shows that after 72 hours, individuals allowed only 30 minutes per day to sleep, or a total of 1.5 hours sleep during the 72-hour period, performed nearly 25% better than subjects getting no sleep at all. The daily 30-minute nap in those individuals was extremely concentrated and thus efficient. Subjects spent nearly the entire 30 minutes in deeper sleep stages, with almost no time awake or in stage 1 sleep.

Thus even short bouts of sleep will improve performance. Thirty minutes of sleep per day reduces the rate of cognitive performance degradation from 25% per day to 17% per day.



However—to repeat—the key is that a nap must actually consist of sleep, either REM or non-REM. Also, as long as they contain *equal sleep amounts*, several short sleep bouts will be just as restorative as one long sleep bout. Although quiet rest during wakefulness may make the individual feel better, it does not restore or sustain mental operations. Overall it is

recommended that individuals sleep as long and as often as needed to obtain 8 hours of it per day.

Whether a nap will be beneficial depends upon such factors as timing, noise, light levels, and ambient temperature. Factors affecting sleep are outlined in Table 1.

<b>FACTOR</b>	<b>CONTRIBUTION</b>
Timing of Sleep Period	<ul style="list-style-type: none"> <li>● Sleep periods timed for early morning (near body temperature trough) or early afternoon (post-lunch dip) more likely to result in restorative sleep.</li> </ul>
Ambient Noise	<ul style="list-style-type: none"> <li>● Intermittent noises (e.g., telephone ring) more disruptive than continuous, monotonic noise.</li> <li>● Use constant "white noise" (e.g., fan) and/or ear plugs to mask intermittent sounds</li> <li>● "Relaxation tapes" prior to sleep may increase feelings of relaxation, but do not objectively improve sleep.</li> <li>● Avoid presenting anything during sleep period; may be disruptive (e.g., audio tapes for "learning while asleep").</li> </ul>
Ambient Light Levels	<ul style="list-style-type: none"> <li>● Light is source of stimulation, making it difficult to fall asleep.</li> <li>● Darken sleep area to extent possible.</li> <li>● Sleep masks or eye patches block remaining ambient light.</li> </ul>
Ambient Temperature	<ul style="list-style-type: none"> <li>● Small deviations above or below comfort zone may disrupt sleep.</li> <li>● Provide clothing/blankets in cold environments.</li> <li>● Provide fans in hot environments (can double as source of white noise).</li> </ul>
Warm Bath	<ul style="list-style-type: none"> <li>● Warm bath may increase subsequent sleep by raising brain temperature.</li> <li>● Physical exercise exerts similar effects but can be disruptive if of high intensity just prior to bedtime.</li> </ul>
Stimulants (e.g., caffeine)	<ul style="list-style-type: none"> <li>● If still in body, may increase wakefulness and stage 1 (i.e., decrease nap's recuperative value).</li> </ul>
Sedatives (e.g., alcohol)	<ul style="list-style-type: none"> <li>● Even though sedatives increase feelings of drowsiness and may hasten sleep onset, some (especially alcohol) "fragment" sleep (increase wakefulness and stage 1).</li> <li>● Individuals may be unaware that sleep is disrupted--particularly with alcohol; brief arousals to stage 1 and awakenings are not remembered the next day, leading to the perception that sleep was not disrupted.</li> <li>● Withdrawal from substances may disrupt sleep as much as the substance itself.</li> </ul>
Dietary Constituents	<ul style="list-style-type: none"> <li>● No objective evidence that particular constituents objectively improve sleep in otherwise normal, healthy individuals.</li> <li>● Some dietary substances may subjectively improve sleep.</li> </ul>

**Table 1. Factors affecting sleep during designated sleep periods.**

Although post-sleep performance impairments or “sleep inertia” may occur upon awakening from a nap or any sleep period, such grogginess is of relatively short duration and usually dissipates within 20 minutes. Under most circumstances, the benefits of sleep will far outweigh the short-term risk of impaired post-sleep performance.

## **PHARMACOLOGICAL MEANS FOR INCREASING OR IMPROVING SLEEP**

Even when time is available, sleep may be unlikely—for example at midmorning or when the quality of the sleep environment is poor. Under these conditions, non-pharmacological strategies may not be sufficient. Improving sleep with the aid of a sleep-inducing agent may be a solution.

The ideal sleep-inducing agent would commence working immediately, increase recuperative sleep time, and possibly cease working after a short period if the sleep period available was of limited duration. Most important, the ideal sleep-inducing agent would not impair performance after awakening, that is, there would be no drug hangover effect. Many individuals hesitate to take sleep-inducing agents out of fear of the hangover effect.

The sleep-inducing agents triazolam (brand name Halcion), zolpidem (brand name Ambien), and temazepam (brand name Restoril) have been tested extensively both in the laboratory and in the field. All of these agents act similarly, exerting their effects in the same areas of the brain, and reaching peak blood concentrations within approximately 1.5 hours. Triazolam and zolpidem display a shorter duration of action than temazepam, probably because they are eliminated from the body more rapidly. However, a drug’s elimination rate from the body (half-life) does not necessarily predict its duration of action on sleep or mental operations (see below).

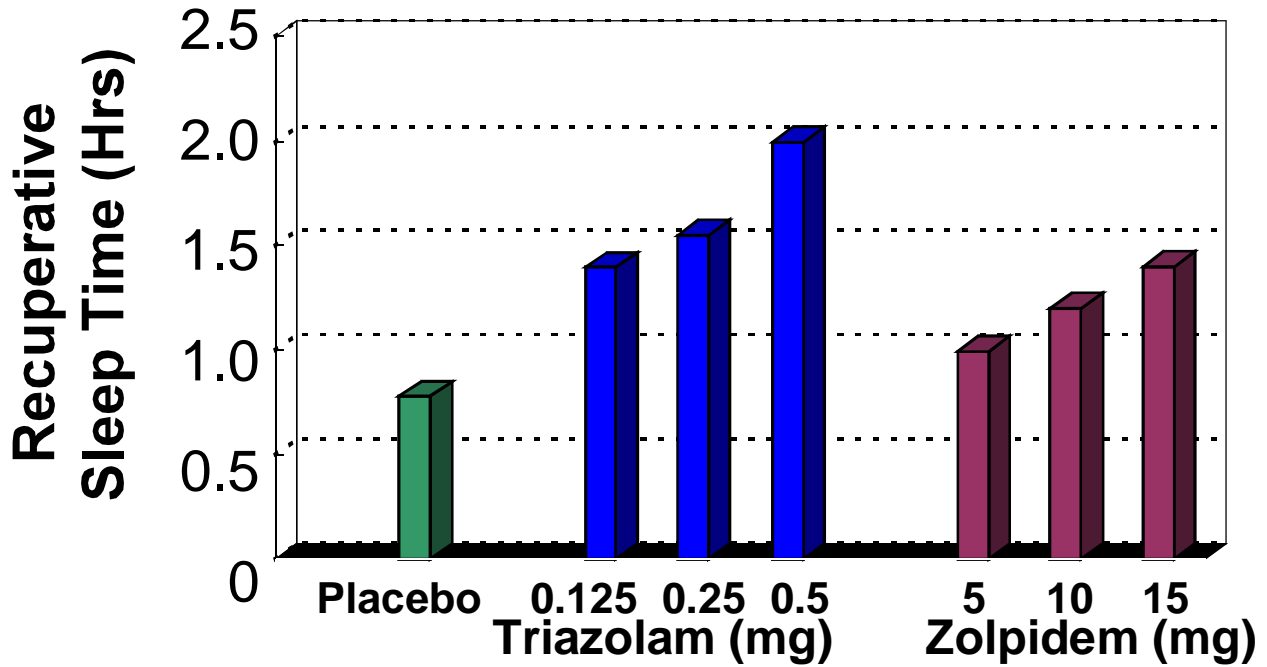
### **Laboratory Evaluations**

Laboratory evaluations reveal that both triazolam and zolpidem improve sleep under simulated troop transport conditions by reducing amounts of wake and stage 1 (Figure 7-top panel). However, twice the currently recommended dose of both drugs is required for this effect (0.5 mg triazolam and 20 mg zolpidem). Additionally, during a worst-case scenario simulation like awakening and confronting a tough mental challenge at these sleep-inducing doses, both drugs impair complex mental operations at peak effect, occurring 1.5 hours after administration (Figure 7-bottom panel). In addition, 0.5 mg triazolam impairs mental performance for at least 6 hours post-dose—an effect not predicted based on the drug’s half-life of approximately 2 hours.

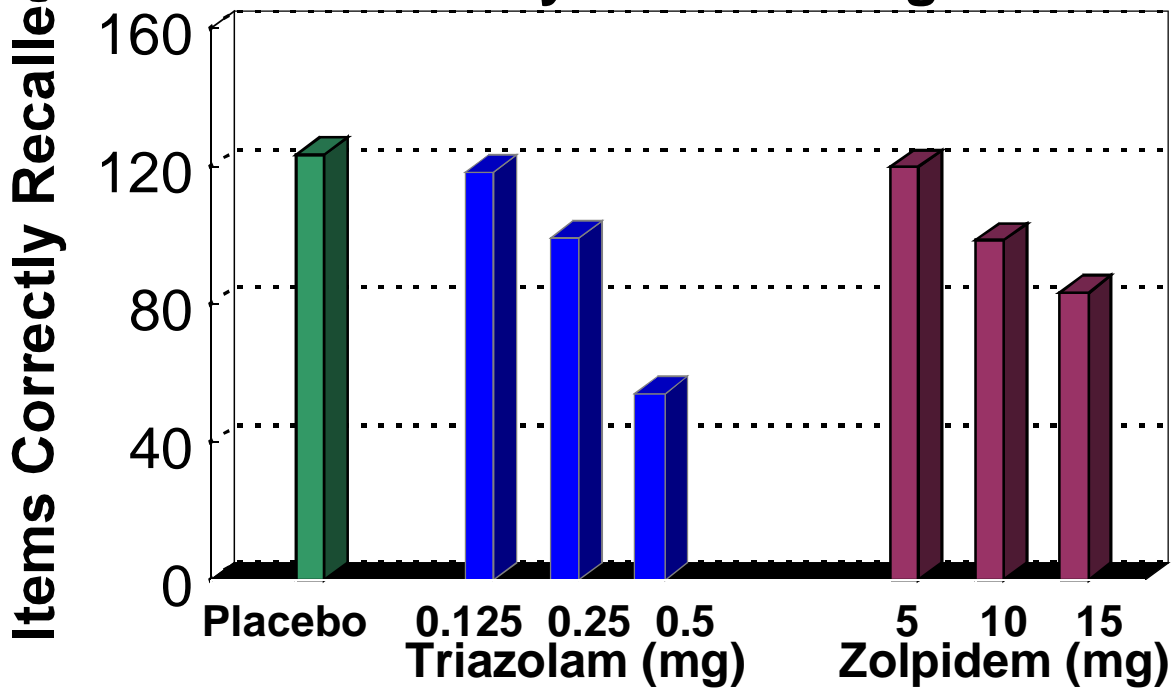


**Figure 7. Effects of Triazolam vs. Zolpidem**

**a. Sleep during Simulated Troop Transport**



**b. Memory at Peak Drug Effect**



## Field Studies

Triazolam has been tested in the field. In a study of Operation Bright Star, 0.5 mg triazolam, twice the currently recommended dosage, did not improve daytime sleep in soldiers during a U.S.-to-Europe deployment, yet impaired complex mental operations up to 8 hours after administration. Although the results suggested that triazolam, at least the 0.5 mg dose, is unsuitable for use during long-range aerial deployments, two key features of the study could account for the poor outcome. First, the in-flight hot meal service started three hours after soldiers had taken the drug or the placebo. Second, even after they had eaten, soldiers had to pass other trays down the line as the meals came out of the two microwave ovens on board. For approximately 3 to 6 hours after the drug was administered, no one slept. Soldiers were required to stay awake at the very time when they should have been allowed to take advantage of the drug's peak sleep-inducing effect. Results of this field study indicated that sleep-inducing agents might be contraindicated during deployment if soldiers will not have an opportunity to sleep relatively undisturbed.

In a field study at Ft. Lewis, triazolam in 0.5 mg and 0.25 mg dosages improved sleep in ranger rifle platoons sleeping in the cold but otherwise not disturbed. However, 0.5 mg triazolam (but not 0.25 mg) impaired performance 4 hours post-dose. Importantly, at 24 hours post-dose, soldiers given 0.25 mg triazolam performed significantly better on complex mental tests than a group given no drug at all. This study again demonstrates the value of relatively small increments of sleep, showing that the benefits derived are long-lasting. Of note in this field study is that triazolam caused some soldiers to fall asleep even before they zipped themselves into their sleeping bags, thus requiring the study investigators to secure the soldiers in their sleeping bags to protect them against the sub-freezing temperatures. Results from this field study thus suggested that sleep-inducing agents might be contraindicated in harsh environments, especially when soldiers cannot be monitored closely.

## Melatonin

Some interesting claims have been made in behalf of the pineal hormone melatonin, namely, that oral-ingested, synthetic melatonin improves sleep and readjusts circadian rhythm. It is often unclear, however, in such reports as to exactly which rhythm is affected, e.g., body temperature, alertness, or performance.

Does synthetic melatonin work? The answer depends upon what one wants to accomplish. For example, after travel between time zones, melatonin hastens resynchronization of body temperature rhythm with new local time. However, whether rapidly resynchronizing body temperature has any practical significance, especially in terms of mental performance, has not been established. Other effects of melatonin are summarized in Table 2. Of note, melatonin's side effects, long-term effects, and minimum effective dosage have not been established.

## **Sleep-Inducing Agents--Summary and Conclusions**

At sufficient dosages, prescription sleep-inducing agents can improve sleep in an operational environment. When sleep-inducing agents are administered, precautions must be taken to ensure that the sleep period is protected by maintaining reasonable control over the sleep environment and providing sufficient down time, and that a sleep monitor is on hand, particularly in hazardous environments. In most instances, sleep-inducing agents can be administered according to labeling instructions (for example, 10 mg zolpidem, 30 minutes prior to bedtime). Higher doses may be required in young, healthy adults or under particularly non-sleep-conducive conditions. Despite popular press sensationalism, when properly used according to packaging directions and considering the contraindications highlighted above, sleep-inducing agents are both safe and effective.

The performance benefits of obtaining sleep must be weighed against the possible risks associated with use of sleep-inducing agents. Despite claims by some drug manufacturers that a particular sleep-inducing agent causes fewer negative side effects than other agents, the literature clearly shows that all sleep-inducing agents, *at sleep-inducing doses*, impair mental performance at their peak sleep-inducing effect. Although some new sleep-inducing agents (e.g. zolpidem and zopiclone) are in a different drug class than the standard sleep-inducing agents (e.g. temazepam and triazolam), these newer agents exert their effects in the same areas of the brain as the standard agents. Current recommendations for using sleep-inducing agents are summarized in Table 2.

## **Sleep-Inducing Agents--Future Directions**

The capability for immediate reversal of sleep-inducing agents in an emergency situation would be desirable. Although stimulants like caffeine may seem an obvious choice, they are only partially effective, most likely because they act at brain sites different from sleep-inducing agents. Recently, the agent flumazenil (brand name Romazicon) was shown to block the most widely used sleep-inducing agents' effects completely and rapidly within 3 minutes of intravenous administration and left individuals alert and able to perform at normal levels. Flumazenil causes no measurable side effects and is not a stimulant like caffeine, but is ineffective during sleep deprivation. Flumazenil has been in use for several years as an antidote to benzodiazepine anesthesia and overdose. For sleep management in the operational environment, a fieldable, dual-drug system for safe sleep induction using effective sleep-inducing agents such as triazolam or zolpidem, electively followed by rapid sleep termination and performance restoration using flumazenil would be ideal. However, flumazenil is currently marketed only in intravenous form and development of an approved orally-administered formulation would be required.

Finally, melatonin has some slight sleep-promoting properties in that it decreases time taken to fall asleep. It may be that a combination of melatonin plus a sleep inducer (e.g. zolpidem) would allow for a lower dose of the sleep inducer to be administered while still improving sleep—and resulting in less post-sleep performance impairment.

AGENT	USE AND PRECAUTIONS
Prescription Agents:  Triazolam, Zolpidem Temazepam, Zopiclone, etc.	<ul style="list-style-type: none"> <li>● Administer according to packaging directions to start.</li> <li>● Higher doses may be required in young, healthy adults and/or under non-conductive conditions.</li> <li>● Combine with non-pharmacological strategies.</li> <li>● Ensure sufficient down time (e.g., at least 6 hrs following triazolam or zolpidem; 10 hrs following temazepam).</li> <li>● Monitor individuals continuously in harsh environments.</li> <li>● Agents impair performance if still in body.</li> <li>● Not for long-term (e.g., greater than 10 days) use - agents may lose effectiveness (i.e., development of "tolerance"); withdrawal may impair sleep.</li> <li>● Though available by prescription, sleep-inducing agents are controlled substances.</li> </ul>
Melatonin	<ul style="list-style-type: none"> <li>● Increases subjective feelings of sleepiness</li> <li>● May improve subjective feelings of sleep quality</li> <li>● Shortens time taken to fall asleep</li> <li>● Does not increase recuperative sleep time</li> <li>● May impair performance if still in body</li> <li>● Effective dose range not established</li> <li>● Purity/additives of over-the-counter preparations may vary</li> </ul>
Over-the-Counter Agents: Sominex, Nytol	<ul style="list-style-type: none"> <li>● Increases subjective feelings of sleepiness</li> <li>● May improve subjective feelings of sleep quality</li> <li>● Little effect on recuperative sleep time</li> </ul>
Other Sedative Agents: Alcohol, Antihistamines	<ul style="list-style-type: none"> <li>● Increases subjective feelings of sleepiness</li> <li>● May improve subjective feelings of sleep quality</li> <li>● May actually degrade sleep, reducing recuperative sleep time</li> </ul>

**Table 2. Pharmacological strategies for improving sleep under non-sleep-conductive conditions**

## **NON-PHARMACOLOGICAL STRATEGIES FOR INCREASING/ IMPROVING COMPLEX MENTAL PERFORMANCE AND ALERTNESS**

Non-pharmacological strategies for improving complex mental performance and the ability to remain awake include bright light exposure and a host of behavioral measures. For the most part, these strategies are minimally effective and only for short periods, and often improve subjective feelings of alertness without improving complex mental performance. These strategies are outlined in Table 3.

Finally, numerous patents have been awarded for methods and devices designed to detect sleepiness and then non-pharmacologically heighten alertness, for example, devices to detect head nods and produce an alerting stimulus such as a vibration or loud noise. The problem with all such devices is sensitivity. That is, by the time the device detects a critical event (e.g.,

the individual's head has begun to nod), an error or accident has probably already occurred. Performance errors due to sleep deprivation begin to occur well before the individual exhibits overt signs of sleepiness.

FACTOR	NOTES
Bright Light Exposure	<ul style="list-style-type: none"> <li>•Timed exposure probably impractical in most operational settings--"appropriate" vs. "inappropriate" light exposure times determined by factors not easily measured in the workplace</li> <li>•Limited exposure is feasible (e.g., wear light-blocking sunglasses in the morning after night shift work).</li> <li>•No evidence that bright light exposure objectively, substantially, and consistently improves mental operations outside of controlled setting.</li> </ul>
Behavioral Strategies: Cold Air, noise (e.g., loud music) Physical Exercise	<ul style="list-style-type: none"> <li>•Improve subjective feelings of alertness</li> <li>•Effects on performance and ability to stay awake are short-lived (less than 30 min)</li> </ul>

**Table 3. Non-pharmacological strategies for improving complex mental operations and the ability to remain awake.**

## **PHARMACOLOGICAL STRATEGIES FOR INCREASING/IMPROVING COMPLEX MENTAL PERFORMANCE AND ALERTNESS**

Although sleep is the best means to combat sleep deprivation, operational exigencies can preclude adequate sleep. Under these circumstances, strategies for augmenting mental performance can be implemented. Currently, the most effective strategy for improving mental performance during sleep deprivation is the administration of central nervous system stimulants.

Information about caffeine, dextroamphetamine (often referred to as d-amphetamine), and nicotine is summarized in Table 4.

### **Caffeine**

When administered as a single oral dose after 48 hours of sleep deprivation, caffeine restores complex mental operations (Figure 8-top panel). Caffeine in 150, 300, and 600 mg dosages is equally effective for approximately 1 hour post-administration, but only 600 mg

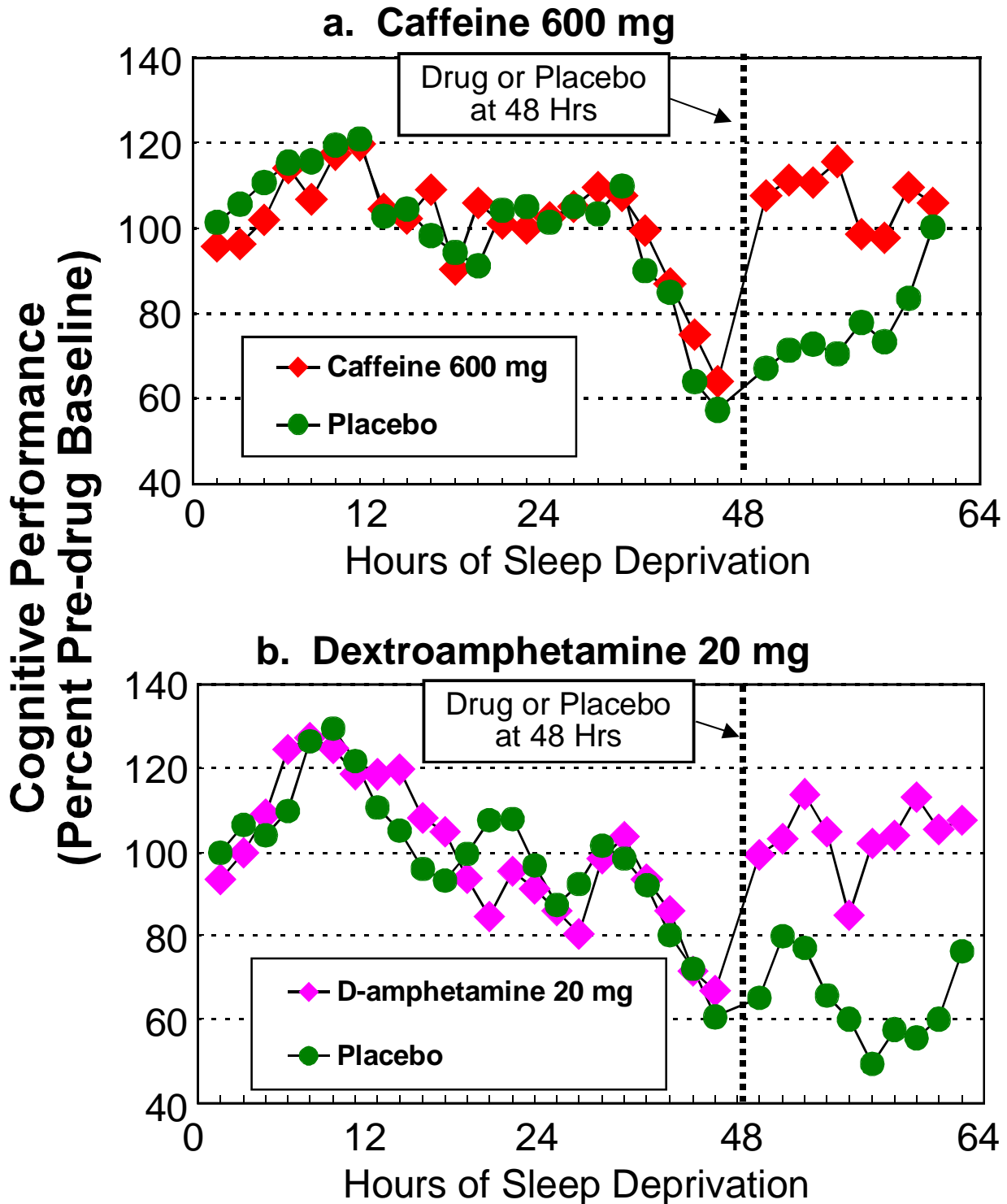
sustains restored performance for at least 4 hours post-administration. Caffeine in a 600 mg dosage also increases the ability to remain awake in a non-stimulating environment.

AGENT	USE, FORMULATIONS, AND PRECAUTIONS
Caffeine	<ul style="list-style-type: none"> <li>● Caffeine 600 mg (about 6 cups coffee) improves mental performance and alertness when administered after 48 hours total sleep deprivation.</li> <li>● Available commercially over-the-counter in tablets such as Vivarin® or No-Doz® and can be administered according to packaging directions to start.</li> <li>● Gum formulation (50 mg caffeine per stick) available commercially over-the-counter as StayAlert® may be more rapidly absorbed than tablets, allowing for a lower dose.</li> <li>● May cause jitteriness, nervousness, anxiety, nausea, and talkativeness.</li> <li>● May interfere with sleep if a sleep opportunity becomes available after administration.</li> <li>● Tolerance may develop with repeated use.</li> </ul>
Dextroamphetamine	<ul style="list-style-type: none"> <li>● Dextroamphetamine 20 mg improves mental performance and alertness when administered after 48 hours of total sleep deprivation.</li> <li>● Available by prescription as Dexedrine® (controlled substance).</li> <li>● May cause jitteriness, nervousness, nausea, talkativeness, anxiety.</li> <li>● May interfere with sleep (see above, caffeine).</li> <li>● Tolerance may develop with repeated use.</li> <li>● Possesses some abuse potential.</li> </ul>
Nicotine	<ul style="list-style-type: none"> <li>● Does not improve mental performance or alertness when administered after 48 hours of total sleep deprivation.</li> <li>● May cause nausea.</li> </ul>

**Table 4. Pharmacological strategies for improving mental operations and alertness during total/partial sleep deprivation.**

Caffeine interferes with sleep even 12 hours after ingestion. However, whether caffeine-impaired sleep translates into next-day performance impairments as a result of partial sleep deprivation depends on the total amount of actual recuperative sleep time

**Figure 8. Stimulant Drugs: Effects on Cognitive Performance During 64 Hours of Sleep Deprivation**



obtained. For example, in one study 300 mg of caffeine reduced recuperative sleep duration by an hour compared to a placebo group. However, reduced sleep did not translate into next-day performance impairments because the overall amount of recuperative sleep obtained was more than seven hours. Had the sleep period been shorter, the impact of a 1-hour reduction in sleep may have been more salient. Similarly, had the sleep period commenced nearer to caffeine administration (e.g., 4 hours after administration versus 12), or had the sleep deprivation period been shorter, caffeine's effects on sleep may have been more striking. The long sleep deprivation period drastically increased sleep propensity, partially offsetting caffeine-induced decrements in sleep propensity.

In sum, caffeine at a 600 mg dosage effectively restores the ability to remain awake under boring, non-stimulating conditions, and it restores the ability to perform complex mental operations. However, caffeine also produces some mild subjective effects (both negative and positive perception), and can interfere with subsequent sleep.

## **Dextroamphetamine**

When administered after 48 hours of sleep deprivation, 20 mg of dextroamphetamine is effective for restoring mental operations to baseline levels (Figure 8-bottom panel), and it increases alertness in non-stimulating environments.

Subjectively, dextroamphetamine improves self-ratings of energy level, vigor, and alertness. It also interferes with recovery sleep; however, results from a U.S. Army Aeromedical Research Laboratory study show that the recovery sleep-reducing effects of dextroamphetamine do not translate into measurable deficits in next-day performance. Again, however, the overall amount of recuperative sleep obtained even with dextroamphetamine in that study was more than 7 hours. As with caffeine, the impact of a 1-hour loss may have been more salient had the sleep period been shorter, had the sleep deprivation period been shorter, or had the sleep period commenced closer to the time of drug administration. In any event, caffeine 600 mg and 20 mg dextroamphetamine restore cognitive performance to levels seen prior to total sleep deprivation.

## **Other Agents**

Other agents with alleged stimulant-like properties (mostly subjective) have been evaluated for effectiveness in counteracting mental performance and alertness impairments during sleep deprivation. Nicotine is ineffective for combating sleep-deprivation-induced mental performance or alertness degradation. Nicotine does not improve mood and causes nausea in some individuals. Many Ranger students use smokeless tobacco during Ranger training. One graduate of Ranger school recounted how Ranger students would place smokeless tobacco in their eyes to stay awake. They also would swallow tobacco juice to keep them going, hence its name "go-juice." However, it is important to note that although nicotine may have resulted in improved subjective alertness, go-juice is a poor makeshift for restoring or maintaining complex mental performance. In fact, there may be dangers associated with using substances such as nicotine, since such substances may increase feelings of alertness without actually improving mental performance to a comparable extent.



Flumazenil has also been evaluated for potential performance-restoring effects during sleep deprivation. However, flumazenil is completely ineffective and possesses no stimulant properties. Its effectiveness for reversing the effects of sleep-inducing agents is due exclusively to its ability to counteract the effects of specific sleep-inducing agents.

## **Stimulant Agents--Future Directions**

Modafinil (brand name Provigil) is a new stimulant agent currently indicated for improving alertness in narcolepsy, a sleep disorder characterized by excessive, uncontrollable daytime sleepiness. Claims have been made that modafinil does not act at the same brain receptors as either caffeine or amphetamine, but in fact its mechanism of action is not known. Moreover, though modafinil improves alertness in narcoleptics, whether it substantially improves complex mental performance in sleep-deprived normal individuals has not been demonstrated.

Other questions that would need to be answered include whether modafinil has favorable tolerance and abuse-potential characteristics, whether it interferes with post-sleep-deprivation recovery sleep, and if it does so interfere, whether such interference translates into performance deficits. Preliminary results indicate that at the doses tested, modafinil is no more effective than caffeine in improving complex mental performance during sleep deprivation.

## **SUMMARY AND CONCLUSIONS**

Sleep sustains effectiveness. Sleep deprivation, whether total or partial, impairs the ability to stay awake under boring or non-stimulating conditions. Even under highly stimulating or challenging conditions, sleep deprivation impairs complex mental operations, including the ability to judge one's own level of mental effectiveness.

Decreased activation of specific brain areas underlie sleep deprivation-induced mental performance and alertness impairments. However, the reason for these regional deactivations during sleep loss remains a mystery. Once these mechanisms are understood, far more effective methods for managing sleep and alertness might be developed. For now, both pharmacological and non-pharmacological methods can improve sleep under non-sleep-conducive conditions. When short-term sleep deprivation is inevitable, only pharmacological means have been demonstrated to effectively and consistently restore and maintain complex mental performance and alertness.

When viewed at the level of the organization, one individual's poor performance may not become evident until (1) the declining performance falls outside of a critical envelope; or (2) the performance of others also begins to decline, causing a synergistic failure. To deal with either situation effectively, sleep must be measured at the individual level. This will allow effective sleep management strategies to be implemented at both the individual and organizational levels, as appropriate.

## ENDNOTES

1. For earlier treatments of the sleep deprivation problem in an operational setting, see Frederick J. Manning, "Continuous Operations in Europe: Feasibility and the Effects of Leadership and Training," *Parameters*, Vol. 9, September 1979, pp. 8-17; and Jonathan Shay, "Ethical Standing for Commander Self-Care: The Need for Sleep," *Parameters*, Vol. 28, No. 2, Summer 1998, pp. 93-105.
2. W. C. Dement and C. Vaughan, *The Promise of Sleep*, New York: Delacorte Press, 1999, p. 53.
3. G. L. Belenky, J. A. Martin, and S. C. Marcy, "After-action Critical Incident Stress Debriefing and Battle Reconstruction Following Combat," in J. A. Martin, L. R. Sparacino, and G. L. Belenky, eds., *The Gulf War and Mental Health: A Comprehensive Guide*, Westport, CT: Praeger, 1996, pp. 105-113.

## CHAPTER 7

### INJURY CONTROL FOR PHYSICALLY ACTIVE MEN AND WOMEN

Joseph J. Knapik and Rebecca L. McCollam

#### INTRODUCTION

A physically active lifestyle is encouraged by almost everyone involved in health care. Moreover, experts claim that exercise does just about everything from extend longevity to improving the quality of life. These claims are well supported. Dr. Ralph Paffenbarger reported in 1986 that former Harvard University students had a lower risk of mortality from all causes if they exercised in their leisure time.<sup>1</sup> Death rates declined steadily as physical activity increased. In other research, Dr. Barbara Sternfeld concluded after a comprehensive look at the literature that individuals who were more physically active had lower risk of developing colon cancer and possibly breast cancer.<sup>2</sup> Dr. Kenneth Powell and his coworkers at the Centers for Disease Control and Prevention also comprehensively reviewed articles published on physical activity and chronic diseases. Their work revealed that in addition to positive effects on longevity and cancer, physical activity reduced the risk of coronary heart disease, reduced symptoms of depression, and improved mood states.<sup>3</sup> Given all these beneficial effects of physical activity, it is no wonder that exercise is strongly promoted.

However, what is seldom considered in discussions of exercise is the potential for injury. That activity increases injury risk should not be surprising since there are physical hazards inherent in just about anything you do. When you get out of bed in the morning, you run the risk of twisting your body the wrong way and hurting your back. When you brush your teeth, you may accidentally cut the gums of your teeth. Driving to work in the morning, you risk a motor vehicle accident.

Like these activities of daily living, exercise has its own set of risks. This can be illustrated by our findings among senior military officers at the U.S. Army War College in Carlisle, Pennsylvania.<sup>4</sup> These officers averaged 43 years of age and were very active, participating in softball, volleyball, basketball, and other physical activities. They were also required to pass the Army Physical Fitness Test twice during the academic year, so most officers ran and performed calisthenic-type exercises. We found that 56% of these officers suffered at least one injury during their 10-month stay at the War College. Where a cause of injury could be determined, 77% were due to sports or exercise. Fortunately, most of these injuries were relatively minor, with only 23% resulting in some physical limitation and none of them causing permanent disability.

It is prudent to balance the benefits of physical activity against the risk of injury. It may even be possible for you to tip the balance in your favor if you understand what increases your risk of injury and you act to minimize these risks. We will help you do this by discussing

various risk factors that will increase your likelihood of injury and then offering practical suggestions on how to avoid injury. We will then provide some general guidelines for injury first aid that will help you heal faster should you suffer an injury. Finally, we will review the types of injury commonly encountered by physically active people. Our purpose is to provide you the tools to enjoy the benefits of physical activity while reducing your odds of suffering an injury.

## RISK FACTORS FOR INJURIES

Over the last 20 years considerable progress has been made in identifying factors that put individuals at risk for injury. A list of demonstrated risk factors is provided in Table 1. Some risk factors are “extrinsic,” meaning they are characteristics of the environment in which you are exercising. Other risk factors are “intrinsic,” meaning that they are characteristic of you, the active person. In this section we will discuss these risk factors and explain some common-sense ways you can use this information to reduce your risk of injury.

<p><b>EXTRINSIC FACTORS</b></p> <p>Running Distance Running shoes Weather</p> <p><b>INTRINSIC FACTORS</b></p> <p>Prior physical activity Physical fitness Aerobic fitness Muscular endurance Flexibility Past injuries Cigarette smoking Life and job satisfaction Gender Age Anatomic factors Foot arch height Knee alignment</p>
<p><b>Table 1. Risk Factors for Exercise-Related Injuries</b></p>

### EXTRINSIC RISK FACTORS

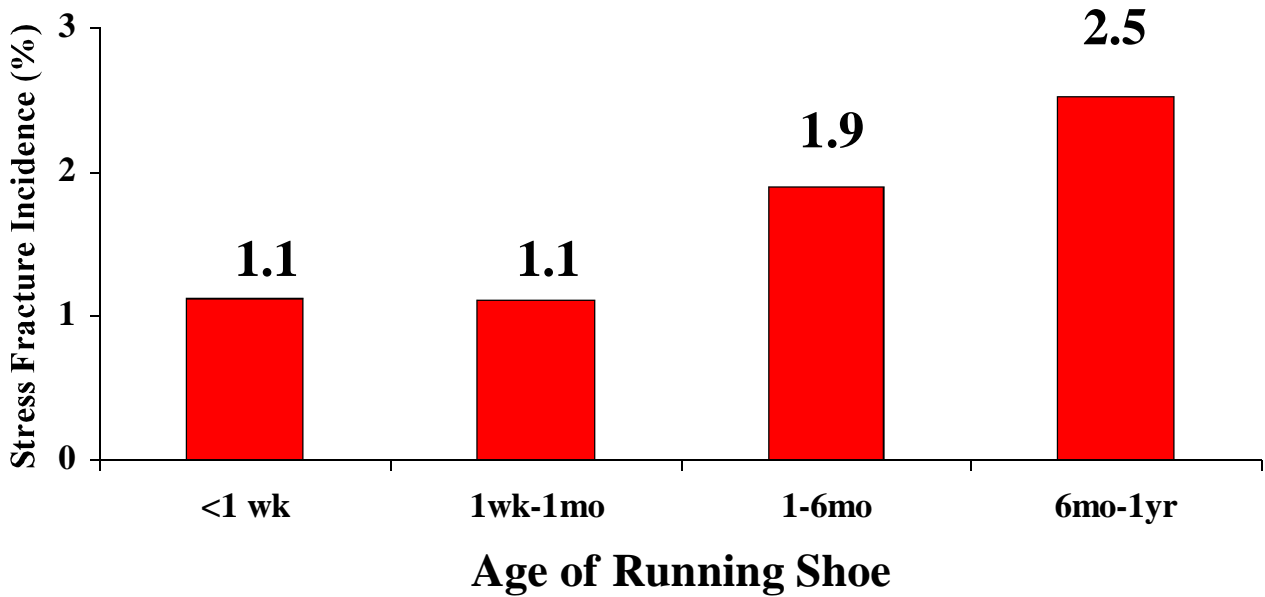
*Running Mileage.* Studies of runners and basic trainees have shown that as running mileage increases so does the risk of injury.<sup>5</sup> It would thus seem wise to limit your mileage to the minimum required for health and/or fitness. But what is this level? The real answer is that we do not know; however, a study by Dr. Michael Pollock provides some insight.<sup>6</sup> Table 2

shows the association of frequency and duration of running with injury incidence from Dr. Pollock's study.

Exercise Frequency			Exercise Duration		
Frequency (days/wk)	Injury Incidence (%)	Aerobic Fitness Improvement (%)	Duration (min/day)	Injury Incidence (%)	Aerobic Fitness Improvement (%)
0	0	-3.4	0	0	0.7
1	0	8.3	15	22	8.7
3	12	12.9	30	24	16.1
5	39	17.4	45	54	17.0

**Table 2. Effects of Frequency and Duration of Running on Injury Incidence and Aerobic Fitness**

**Figure 1. Stress Fracture Incidence by Age of Running Shoe**



If you look at the number of exercise days per week (exercise frequency) you can see that more days result in more fitness, but injury rates increase disproportionately. If you look at the amount of time spent exercising each session (exercise duration), you will note that there is little change in fitness after 30 minutes of exercise, but injury rates more than doubled at 45 minutes of exercise. Thirty minutes per exercise session is not a magic number, but it might be a good guideline to keep in mind. The amount of exercise you can perform without significantly increasing the risk of injury will also vary based on intrinsic risk factors discussed later.

*Running Shoes.* As every athlete knows, there comes a time when it is necessary to replace one's tried and true running shoes due to age and wear. However, this need probably arises much sooner than many would expect. We often take our athletic footwear for granted, seldom examining the degree of wear and tear imposed on them. Dr. Lytt Gardner and his coworkers studied Marine recruits at Parris Island and found that those who began training with newer running shoes had a lower incidence of stress fractures, as shown in Figure 1.<sup>7</sup>

Dr. Gardner speculated that aging of the shoe adversely affects its mechanical support and cushioning ability. This suggests that frequent examination of athletic shoes and replacement when they show signs of excessive wear may reduce the incidence of some types of injury. A good rule of thumb is to replace your shoes when you have worn through the first bottom layer (good running shoes have multiple bottom layers). This often occurs on the outside edge at the back of the shoe. In addition, if the upper portion of the shoe is so damaged that you experience excessive lateral motion, it may be time to look for a new pair. Check your shoes often and replace them when worn.

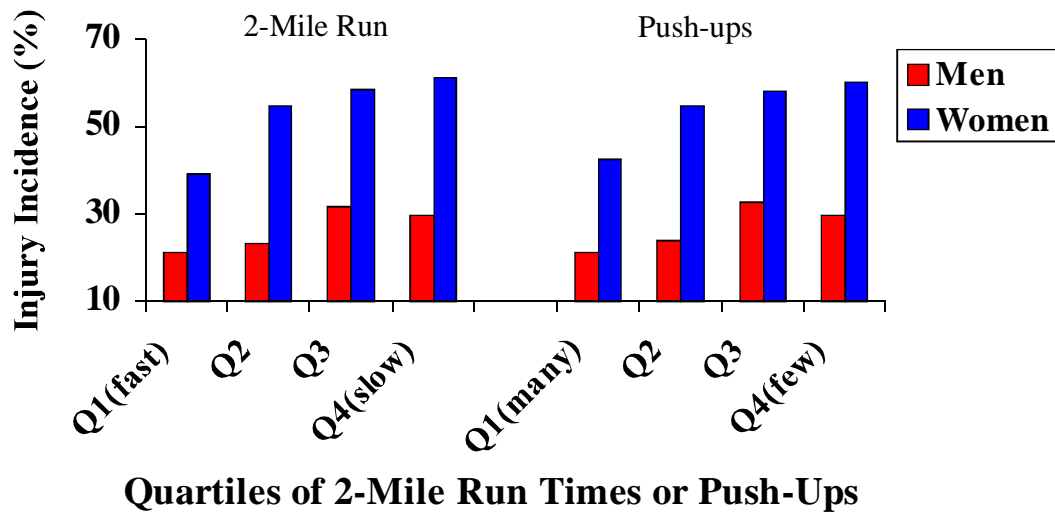
Although athletic shoe companies may tell you that one pair of shoes is better than another for avoiding injuries, no studies thus far have validated this claim. However, there are some commonsense guidelines you can follow when purchasing your shoes—a most important piece of equipment. All athletic shoes should provide good shock absorbency and traction, and be flexible in the forefoot (where the foot bends in normal walking). The back of the shoe should hold to your heel, but you should be able to place a finger between the back of the shoe and the back of the heel to assure the shoe is not too small. Stand on your tiptoes and if the shoe slips off your heel try a smaller size. Modern athletic shoes should be comfortable when you first put them on or after just a few minutes of walking. There is no break-in period. Shop for shoes at the end of the day, because your feet are likely to be larger. Try on the shoes with the socks you will wear during activity. Most importantly, select shoes specifically designed for the activity you are performing. Running shoes, for example, are designed for forward motion and generally do not have proper lateral support for sports that require side-to-side movement like racquetball or tennis.

*Weather.* If you have exercised in warmer weather, you know that compared to cooler weather the effort is much greater and fatigue sets in much faster. Injuries to muscles, bones, and joints have been shown to increase for both men and women as the temperature rises.<sup>8</sup> It may be prudent to slow down and possibly exercise for a shorter period of time when the weather is hot and/or humid.

## INTRINSIC RISK FACTORS

*Prior Physical Activity.* Several studies have indicated that those most vulnerable to injury are those who have not been physically active in the past.<sup>9</sup> It may be that those who have been less physically active have not developed the stronger bones, muscles, and joint structures that tend to resist injury. If you are just starting an exercise program, it is best to follow the time-honored advice of increasing your exercise duration and intensity slowly over time. If you have been exercising regularly, your risk of injury may be lower. However, even if you have been exercising on a regular basis, take care in further increasing the duration or intensity of your activity. More suggestions on how to progress in an exercise program will be given later.

Figure 2. Association of Maximal Effort Two-Mile Run Times, Push-Ups, and Injury

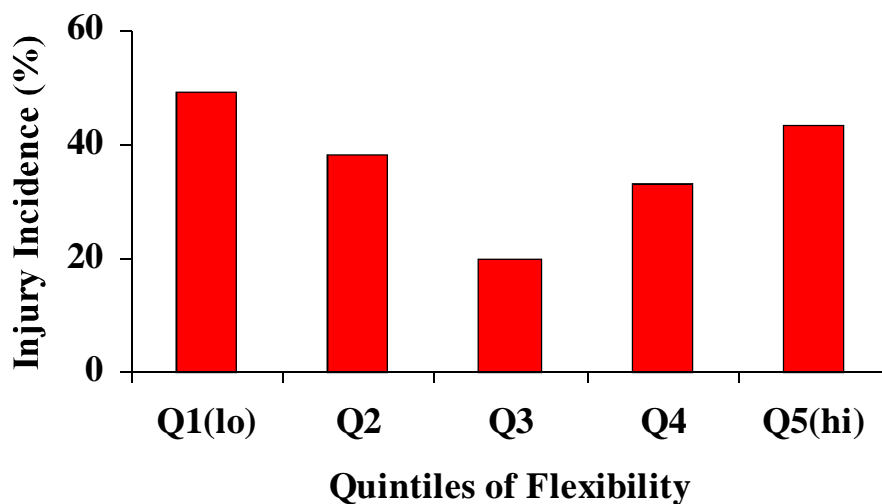


*Aerobic Fitness and Muscular Endurance.* Physical activity and physical fitness often go hand in hand because if you participate in activity of sufficient intensity, frequency, and duration, you will increase your overall fitness. Low aerobic fitness and low muscular endurance are also associated with higher injury risk as revealed in Figure 2, which shows increasing injuries for those performing more poorly in the two-mile run (aerobic) and

push-ups (muscular) during maximum efforts.<sup>10</sup> These findings also support the practice of progressing slowly in a program of physical activity. As you build fitness, your injury risk will decrease.

*Flexibility, Stretching, and Warm-up.* It is often thought that more flexibility leads to less injury and less flexibility leads to more injury. Recent findings suggest that this is only partly true. A number of studies now indicate that those at both extremes of flexibility are at higher risk of injury, as shown in Figure 3.<sup>11</sup> Popular opinion has it that stretching is an injury-prevention technique, but this notion is one of the enduring myths in sports medicine. Two well-controlled studies have shown that stretching does not reduce injuries. Dr. W. H. Van Mechelen, a Dutch sports medicine physician, compared a group of runners who stretched (before and after running) with those who did not. At the conclusion of the study, there were no differences in injuries between the two groups.<sup>12</sup> More recently, Dr. Rodney Pope and his coworkers compared groups of Australian basic trainees who stretched prior to exercise to those who did not. Again, there were no differences in injury rates between the two groups.<sup>13</sup>

Figure 3. Association of Flexibility and Injury



Does this mean that you should not stretch before and after exercise? No, it just means we currently have no evidence that stretching will either help or hurt when it comes to injury control. On the other hand, warming-up before exercise may have some favorable physiological effects that could reduce injuries. These include an increase in body temperature and blood flow, which allows the muscles to contract more forcibly and move



with less effort. Warm-up may also result in modest increases in flexibility in the joints involved in the movements.<sup>14</sup>

Although there are a number of different types of warm-ups, the task-specific type may be most effective. You can create a task-specific warm-up for almost any activity by mentally picturing the types of movements you will make during the activity itself. After you have envisioned these movements, perform them, gradually at first, then increasing intensity over time. For example, if you are going out for a run, you might start out by walking, increase the pace to a fast walk, break into a jog, and then increase slowly up to your training speed. If you are playing volleyball, you could warm up by practicing sets, spikes, digs, and blocks, increasing in intensity over time. Basketball players can practice shooting, running, and dribbling, increasing the activity intensity as game time approaches.

It is a good idea to perform a secondary warm-up if you have been inactive for awhile or if you are involved in sports that have intermittent activity. For example, as a batter in softball, envision the tasks you may have to perform. These are swinging at the ball and running the bases. To warm up, you could practice swinging the bat (or bats) and performing some short sprints or running in place. In sports like volleyball and basketball, where the action is relatively continuous, you may be less susceptible to cooling down. However, if you enter the game from the bench you might practice some game-like movements before the whistle blows.

*Past Injuries.* It is quite possible that a past injury may increase risk for future injury. Senior military officers at the Army War College who suffered an ankle sprain in the previous 5 years were more likely to suffer another sprain.<sup>15</sup> This tendency has also been found in other groups of active people such as soccer players and soldiers.<sup>16</sup> If you have had a prior ankle sprain and are physically active, see a health care provider, who may recommend an appropriate brace. Certain types of ankle braces have been shown to reduce the likelihood of reinjuring the ankle.<sup>17</sup>

*Cigarette Smoking.* Another factor that increases the likelihood of injury is cigarette smoking. This has been confirmed in many groups, ranging from industrial workers to infantry soldiers.<sup>18</sup> Figure 4 suggests that the more cigarettes you smoke, the higher your risk of injury becomes. However, the reason for this relationship is not clear. Psychosocial factors such as greater risk-taking behavior and specific cognitive changes (e.g. lack of attention, altered mental state induced by nicotine) may play a role. Also, smokers do not heal as quickly as non-smokers and have impaired immune systems, which could increase injury rates.<sup>19</sup> Regardless of the reasons for this relationship, you should be aware that if you use tobacco products your risk of injury will be higher.

*Life and Job Satisfaction.* Psychological factors also appear to play a role in injuries. Figure 5 shows the association of injury incidence with life and job satisfaction among senior military officers at the Army War College.<sup>20</sup> Individuals who arrived at the Army War College reporting greater job satisfaction or greater overall life satisfaction were at lower injury risk during their 10-month assignment. This suggests that a more positive outlook on one's current life and job situation may protect against injuries.

Figure 4. Association of Cigarette Smoking History and Injury

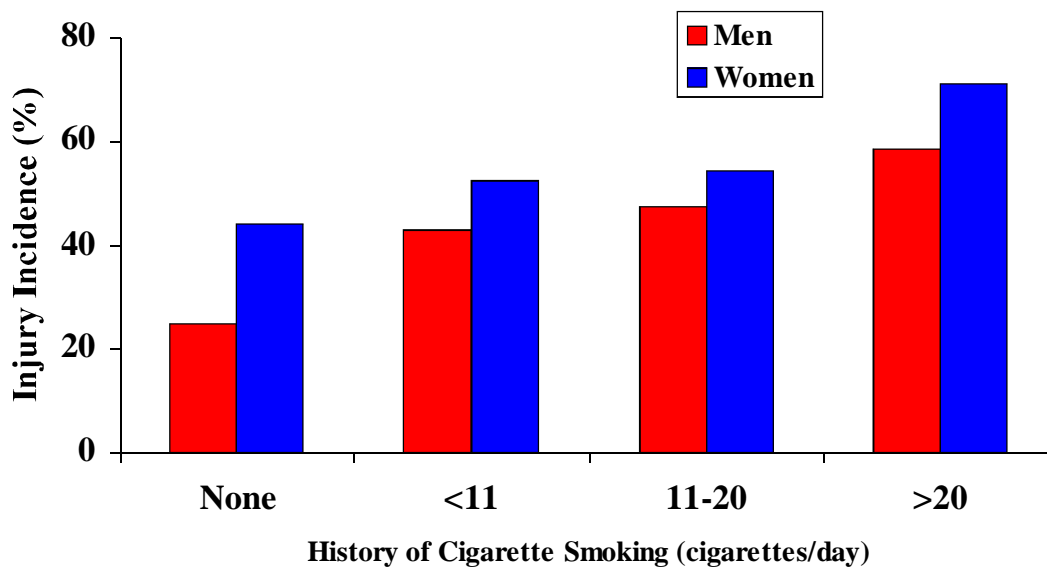


Figure 5. Association of Job and Life Satisfaction with Injury Incidence



*Gender and Age.* Several studies have shown that women are at greater injury risk than men, and that older individuals are at higher injury risk than younger ones.<sup>21</sup> However, all these studies were conducted in U.S. Army basic training, where everyone is required to do the same activity at a similar pace. In the civilian athletic world, men and women generally compete separately, at their own pace, and experience a similar injury risk.<sup>22</sup> Additionally, in environments where older individuals are likely to be able to control the intensity of their activity, older individuals actually have lower injury rates than younger ones.<sup>23</sup> The message is fairly clear: control your own exercise program and do not be concerned with keeping up with others. Women, in general, should exercise less intensely than men; older individuals should exercise less intensely than younger ones. Of course there will be the unusual woman who can successfully compete with men, or the 60-year-old marathoner who can still run the distance in 3 hours. However, these are the exceptions and you should not let others control how long, how often, or how intensely you exercise.

*Anatomic Factors.* As with gender and age, there is little that can be done about one's inherent anatomic features. However, like age and gender, a knowledge of what may put you at increased risk may help you design your exercise program and understand the limits of your body. Individuals with high foot arches are at increased injury risk compared to individuals with normal arch heights.<sup>24</sup> Individuals who are knock-kneed (i.e. have their knees turned more toward the midline of the body) are also at higher risk of injury. Bow-legged individuals appear to have injury risk similar to that of persons with normally aligned knees.<sup>25</sup> Remember, not everyone who has these conditions experiences injuries, but these conditions do increase your risk. You may have to be more careful with your exercise intensity and the types of exercise you perform if you have these anatomic features.

You can reduce your risk of injury by understanding and modifying the risk factors cited above. Remember that, all other things being equal, the individuals at highest risk of injury will be those who are less physically active, are less physically fit, have either high or low flexibility, have had a prior ankle sprain, are smokers, have lower life satisfaction, are female, are older, and/or have knock-knees or high foot arches. However, not all things have to be equal. You can control the likelihood of injury by following the general guidelines above after adapting them to your experience.

## **OTHER INJURY CONTROL STRATEGIES**

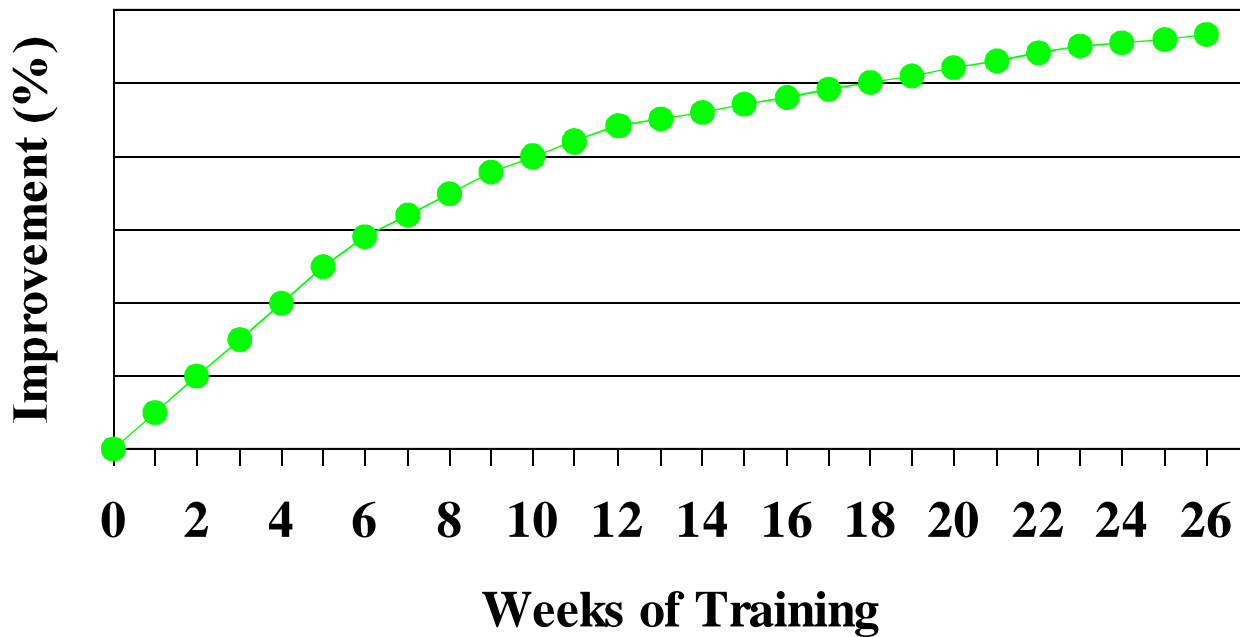
In addition to modification of risk factors, there may be several other methods of controlling injury. These include appropriate progression in your exercise program, the use of protective equipment, understanding the warning signs of impending injury, and a program of spinal stabilization. Many of these injury control strategies have not yet been specifically tested for their injury reduction capability, but common sense and anecdotal evidence suggest they may be effective.

## EXERCISE PROGRESSION

Probably the biggest single training mistake most people make is performing too much exercise before the body is ready for it. The body adapts to the stress of physical activity by increasing the strength of the heart, muscles, bones, ligaments, tendons, and other structures.<sup>26</sup> Too much stress too soon will likely result in a breakdown in one or more of these structures. E. C. Frederick tells us that “we should approach [exercise] not as if we were trying to smash our way through some enormous wall, but as a gentle pastime by which we can coax a slow continuous stream of adaptations out of the body.”<sup>27</sup>

When it comes to exercise, people have different tolerance levels based partly on their injury risk factors. This makes it difficult to provide strict exercise levels that will result in health adaptation and avoid unhealthy breakdown. We recommend following the 10% rule if you are just starting an exercise program. That is, you can increase either the duration or the intensity (not both) of your exercise program by 10% each week. If you run, for example, you could exercise for a 10% longer period of time (duration) or complete a standard distance 10% faster (intensity). If you are a weight lifter, you could do 10% more sets (duration) or increase the weight 10% (intensity).

Figure 6. Hypothetical Improvements Expected from Physical Training



You will eventually reach a point where you will no longer be able to achieve a 10% per week improvement. This is because the body has inherent limits that you cannot exceed. Even the most elite athletes do not improve indefinitely. You can reach a point where a 5% or even 1% improvement is difficult to achieve. Figure 6 shows a sample of the rate of improvement that might be expected if one continues to increase the duration or intensity of exercise over a period of weeks. Improvements of 10% are easily achieved early in your exercise program, but the expected improvements level off later in the program. Only small improvements over a period of months or years are possible once you have been exercising continuously for a long time.

Another approach to exercise progression often used by athletes is periodization.<sup>28</sup> With this method, you increase the intensity or duration of the exercise in preparation for a particular event like a road race, weight-lifting competition, or tennis tournament. After the event, you decrease the amount of exercise you perform to allow your body more time for rest and recovery. As the next event approaches, you again increase the amount of exercise you perform. You complete these cycles of peaking and resting with longer periods of lower exercise volume in the off-season.

Of course, you may be interested merely in exercise for general health and fitness. If this is the case, remember the study by Dr. Pollock cited earlier.<sup>29</sup> Once you have reached the level of 30 minutes of exercise, it might be best to simply maintain your program at that level and enjoy the long-term health benefits.

## **PROTECTIVE EQUIPMENT**

Depending on the sport in which you participate, some types of protective equipment can considerably reduce your risk of injury as well as pain and discomfort. In this section, we shall discuss the types of protective equipment available and provide you some practical guidelines for selecting appropriate equipment for different sports.

*Bicycle Helmets.* Bicycle helmets are designed to protect the rider's head in case of an impact. Several well-conducted studies performed by Dr. Diane Thompson and her coworkers conclude that "helmets reduce the risk of head injury by 75%, brain injury by 88%, and severe brain injury by at least 75%."<sup>30</sup> They also note that helmets reduce facial injuries by two-thirds. Given these odds, it seems prudent to wear a helmet when bicycling.

Helmets are of three major types: (1) those composed only of polystyrene (like styrofoam), (2) those that have a polystyrene liner covered with a thin plastic shell, and (3) those with a polystyrene liner with a thick plastic shell. Helmets with shells appear to provide better protection. Helmets should have several holes to provide good ventilation so you can dissipate heat coming off your head. In fact, many models have the ventilation holes oriented to take maximal advantage of the airflow produced by bicycling.

When fitting the helmet, ensure that the straps are adjusted to hold the helmet firmly but comfortably on the head and that there is a minimum of movement. Shake your head once you

have fitted the helmet to assure it does not drift in any direction. Adjust the straps so they do not pinch the ears and the strap buckles do not irritate your skin. In February 1998, the U.S. Consumer Product Safety Commission (CPSC) issued federal safety standards for bicycle helmets that take into account shock absorbency and strap strength. Look for the CPSC certification label in helmets you are considering. Other organizations with voluntary standards (on which the CPSC standards are based) include the American National Standards Institute (ANSI), the American Society for Testing and Materials (ASTM), and the Snell Memorial Foundation. If your helmet sustains a significant impact, replace it immediately because its ability to absorb impact is thereby reduced.<sup>31</sup>

*Protective Eyewear.* If you play sports like racquetball and squash, you are already familiar with how fast the ball moves and the possibility of its contact with other players and equipment. In this environment, there exists a risk of eye injury and loss of vision. Goggles and faceguards have been shown to reduce eye injuries in many sports.<sup>32</sup> When you shop for appropriate protective eyewear, avoid open eyeguards (i.e. those that do not have lenses) since documented cases of open eyeguards reveal that objects can still cause eye injury to the wearer.<sup>33</sup> Eyewear should have polycarbonate lenses and an anti-fog coating to prevent condensation build-up from perspiration. Currently, look for eyewear certified by the ASTM. ASTM F803.97 certifies eyewear appropriate for racquet sports and baseball protection, ASTM F1776-97 for paintball protection (paintballs are used in some combat simulation games). There is also the ASTM F659-92 standard for alpine skiing. Since 1999, you may find eyewear certified by the Protective Eyewear Certification Council (PECC), which assures not only testing to ASTM standards, but also a quality control test in an independent laboratory.<sup>34</sup>

*In-Line Skating Protection.* In-line skating has become increasingly popular with young and older athletes alike. The wrist is the most common injury location with this sport, probably due to falls on the outstretched hand. Preliminary studies indicate that the use of wrist guards can reduce the odds of wrist injury by sixfold. Considering that many falls also involve the knees, elbows, and head, protective devices for these body parts may also be a good idea. Protective devices can usually be found anywhere where skates are purchased. Thus far, no independent standards have been developed for this type of equipment.<sup>35</sup>

*Sports Bras.* If you are a woman and have experienced breast pain or discomfort during physical activity, you are not alone. In one survey, 56% of women reported sport-related breast pain and discomfort, much of this connected to excessive movement of the breasts.<sup>36</sup> Recently, there have been many developments in sports bras but there is little research on which types of bras are most effective.<sup>37</sup> Let your comfort be your guide and consider the following. There are two major types of sports bras, the compressive and encapsulation types. Compressive types limit movement by flattening the breasts against the body; this type may be most effective if you are an A or B cup size. The encapsulation type contains molded cups that hold each breast separate while providing support; if you are larger breasted (C or D cup), you may prefer this type. Regardless of the type of bra you choose, ensure that the bra limits breast motion while allowing comfortable breathing during the activities you perform.

Fabrics that incorporate blends of 50% cotton and 50% of another breathable material (like Lycra or Coolmax) may be the most comfortable. Breathable materials can increase

comfort by forcing sweat away from the body. Watch for seams and buckles that may irritate if they are in contact with your body. Look for ample arm room (halter top types) that will not restrict your active arm movements or cause chafing. Finally, many sports bras are also labeled regarding their ability to provide specific amounts of support based on the type of sport. For example, certain sports bras will provide support only for low-impact activities such as walking or low-impact aerobic dance, whereas others are designed to provide additional support for high-impact activities such as running or jumping. Many sports bras are colorful, stylish, fashionable, and can serve as outerwear.<sup>38</sup>

*Breakaway and Compressive Bases.* In baseball and softball, most injuries are caused by sliding into base.<sup>39</sup> Breakaway bases are designed to dislodge when an individual slides into them and have been shown to substantially reduce sliding-related injuries.<sup>40</sup> Compressive bases are constructed to compress inward and downward and to absorb the force of a sliding runner, and these have also been shown to reduce sliding injuries.<sup>41</sup> Adapting rules to allow overrunning of second and third bases eliminates sliding altogether and may also reduce injury. If sliding is allowed, an instructional program on sliding technique will serve as an injury reduction tool.

You can obtain specific information on other protective devices in publications on the sport in which you are involved and by consulting sport and exercise professionals.

## **FEELING YOUR PAIN**

We have all experienced the normal aches and pains associated with a physically active lifestyle. At their least severe, these pains are little more than the normal stiffness experienced on getting up in the morning or rising to your feet after being seated for a long period. Slightly more painful is the normal muscle soreness you might experience from a hard exercise session you had one to three days before. At the extreme is an outright injury that results in severe pain and limits your normal physical activity.

When dealing with aches and pains, you should use the experience you have gained with your body over many years of use. Some stiffness, discomfort, and soreness are inevitable when you exercise and shortly after the exercise period. Moreover, joint and muscle stiffness that resolves with exercise is common in mature athletes and is unrelated to injury. Excessive fatigue and an abnormal lack of enthusiasm for exercise may indicate that the intensity or duration of your activity is too great or that you have not allowed enough time for rest and recovery. Pay particular attention to pain that develops gradually and gets worse with each exercise session, since this is a major sign of an impending overuse injury. Sharp or persistent pain that remains for a long period after exercise is the body's signal that something is wrong and a warning signal to slow down before things get worse. Obviously, you should consult a health care professional for any severe injury or for pain that persists after rest and first aid (described below).

You may be able to gain a general idea of the body tissues that may be injured by monitoring the course of pain. Pain that occurs at the start of exercise, disappears during

exercise, and returns shortly after the end of exercise may be related to inflammation of soft tissues like tendons, muscles, and ligaments. Pain that persists during exercise and improves with rest may be related to a bone injury.

## **SPINAL STABILIZATION**

Another method of reducing the possibility of injury is to strengthen the body's core musculature. These are the muscles in the trunk and back. Research related to trunk rehabilitation, better known as spinal stabilization, supports an aggressive approach to increase strength, endurance, and coordination of these core muscles.<sup>42</sup> In this section, we shall discuss the importance of the trunk and back muscles for injury control, and then provide some practical exercise suggestions to help you strengthen your back and trunk.

Why should we be concerned with our trunk and back muscles? One reason is that these muscles are critical to reducing low back pain and optimizing performance. Low back pain is a major health concern that has reached epidemic proportions in American society. The incidence of low back pain is staggering and growing 14 times faster than the population.<sup>43</sup> It is estimated that 60 to 80% of the general population will experience at least one episode of low back pain during their lifetime and that 70 to 90% of these individuals will develop significant back problems. Once individuals have low back pain, they are 7 to 10 times more likely to have recurrent low back pain. At any given time, 15 to 20% of the population will suffer with low back pain. Low back disorders do not discriminate; all occupations, all social classes, and both sexes are equally affected. Spinal stabilization can help reduce the incidence of low back pain.<sup>44</sup>

A second reason we should be concerned with our core musculature is related to improving performance. The abdominal and back muscles form a supportive ring around the spine similar to a corset. Simply put, muscles have two basic functions, as movers or stabilizers. A mover permits motion to occur around a joint. Some muscles function only as movers, such as the rectus abdominis (the muscle group in the center of the abdomen). The rectus abdominis allows the spinal movement involved in the sit-up. Not as obvious are the muscles that act as stabilizers to control or "brake" movement. These stabilizing muscles protect our joints from unwanted movement while maintaining proper posture and alignment. This braking effect allows for controlled, coordinated, and purposeful movement.

The braking action of the core muscles primarily serves two purposes. First, the spine and pelvis provide a solid, stable base of support for the attachment of the arm and leg muscles. Without a fixed foundation, using these muscles to power the arms and legs would be similar to pushing an object while standing on slippery ice. Secondly, when the core muscles apply the brakes, they promote balanced and controlled movement while maintaining the body's center of gravity within the core.

From this perspective, we see that the traditional sit-up does not adequately train the core musculature. A study conducted by the Australian army discovered that soldiers scoring the best on a timed sit-up test demonstrated poor functional control when attempting to hold the



spine in stable positions.<sup>45</sup> The core muscles function to manage the daily stresses acting on the spine in a safe and effective manner. If the sit-up is the only training we perform for the trunk, we will be ill equipped for the challenges that face our bodies every day and at greater risk for back problems.

How do you go beyond the standard sit-up to train the core muscles? First, it is important to work those core muscles not challenged by the sit-up. Try the exercises below. The goal is to maintain the neutral spine position during each exercise independent of the position. To find the neutral spine position, first arch your back to full range, then flatten the back to full range. Repeat these movements slowly until you find a pain-free and stable position between the two extremes of movement. This is your neutral position. Do not allow your spine to move when performing the exercises recommended in this chapter.

Perform all exercises recommended below in a deliberate, slow, and controlled manner. Progress to faster movements as you improve your control with the exercise. Your breathing should remain slow and rhythmical. Gradually progress to performing each exercise continuously for 3 minutes. Do not focus on the repetitions; instead concentrate on proper technique until you experience muscle fatigue. At the onset of muscle fatigue, stop and change exercises. Perform each exercise a minimum of 3 times per week every other day. Since the trunk muscles are endurance muscles, you can safely work these muscles daily. Remember: Perfect practice makes perfect!

Secondly, you must compensate for the adverse effects of faulty body mechanics, poor posture, poor life-style habits, and repetitive sit-ups (particularly if performed too rapidly). In other words, balance the forces on the spine equally by performing exercises such as back extension and hip stretches. You can overcome the limitations of the sit-up through the following simple additions to your exercise program. The following basic exercises are suitable for anyone.

*Supine Bridging.* Lie on your back. Bend your knees to 90° with your arms at sides. Lift and lower your buttocks keeping your feet on the floor shoulder-width apart and maintaining the neutral position. In the up position, your hips and buttocks should fall midway between your shoulders and knees forming a straight line. Attempt to lift and lower your buttocks without losing the neutral position. Do not push up with your arms. Progress by holding the bridge position and spread your thighs approximately 18 to 24 inches. Do not let your trunk or pelvis sag when moving the legs in and out.

*Supine Combination.* Lie on your back. Bend your knees to 90° with your feet flat on the floor and your arms extended over your chest. Alternately lift (march) your legs off the floor while raising the opposite arm overhead with the thumb up, maintaining neutral position. Progress by raising both arms overhead and then adding light wrist/hand weights with overhead arm movements.

*Lateral Lean "Sit-up of the Millennium."* Lie on one side and prop up on your elbow with weight on the hip and forearm of the same side. Place opposite hand on your hip. Firmly press into the ground with your supporting arm while raising your trunk and hips off the floor

forming a straight line with the body. Repetitively lift and lower in this position until muscle fatigue and repeat on other side.

*Prone with Legs.* Lie face down. Extend your arms overhead. Lift one leg at hip joint with knee joint straight, but not locked. Keep your pubic bones pressed to the floor while maintaining neutral position. Lower your leg and repeat with opposite leg. Progress by adding light ankle weights. Do not allow back to sag.

## **COMMONSENSE FIRST AID INJURY TREATMENT**

Despite your best efforts, you may still experience some injuries. If this happens, your immediate goal should be to reduce the pain, swelling, and inflammation. One specific treatment protocol endorsed by many sports medicine professionals is called RICE—rest, ice, compression, elevation.<sup>46</sup> You can think of the RICE protocol as immediate first aid for many types of injuries. Anti-inflammatory medication may also be helpful in some injury cases.

*Rest.* Use rest to prevent further injury and allow the body sufficient time to proceed with its natural healing processes. The initial rest period should be 1 to 2 days for minor injuries, enough time to allow the inflammation to diminish. Healing severe injuries, on the other hand, may take several days to weeks. For mild injuries (both chronic and acute), rest is relative, requiring only a decrease in the intensity, frequency, and duration of activity. In some cases, you may be able to exercise parts of the body that are not injured. For example, a runner with a leg injury can still perform exercises involving the arms. As a rule of thumb, you can return to your normal exercise when your activity is relatively pain free. A sports medicine professional can also give you valuable information on how to continue training without additional injury and suggest rehabilitation programs.

*Ice.* Use ice to reduce swelling, inflammation, and pain. Ice placed directly over the affected area limits the fluids going into the injured area, deadens nerve fibers, and reduces muscle spasms. Ice is especially effective in the first 24 to 72 hours of the injury. The simplest way to apply ice is to put it into a plastic bag. Place a damp towel over the injured area, and then put the ice pack over the towel, allowing it to conform to the contours of the body. Avoid placing dry towels or plastic directly on the skin since these can cause ice burns. Ice should be applied only for 20 minutes at a time. For acute temporary injuries, a cold pack can be applied every 2 to 3 hours for the first several hours; later, use ice twice a day. For chronic (long-term or recurrent) injuries, massaging with chunks of ice or ice frozen in paper cups can be effective. Apply slow circular strokes for up to 20 minutes, 2 to 3 times per day.

*Compression.* Compression reduces internal bleeding and swelling of the affected area. Elastic wraps (e.g. Ace bandages) can be used for this purpose. Avoid wrapping the elastic too tight, and guard against the elastic rolling up; either of these missteps can cut off your circulation. Constant monitoring is important. You can combine compression and ice by placing the ice over a damp elastic wrap. Do not use elastic wraps over an active joint (e.g. knee when running), since the wrap can easily roll up and reduce circulation.

*Elevation.* Elevation reduces swelling and the entry of fluids into the affected area. The injured area should be raised above the level of the heart (i.e. mid-chest). Place the injured area in a comfortable position so you can maintain the elevation with minimal distress.

*Anti-Inflammatory Medication.* Many anti-inflammatory medications may be obtained without a prescription. Generic medications with names like aspirin, ibuprofen, and naproxen can help reduce pain and inflammation. You should not use these medications within the first few days of injury because they may interfere with healing processes. These medications are best for chronic conditions like plantar fasciitis or tendinitis.

No medication is without side effects. If you choose to take over-the-counter medications, read and follow the directions on the label. Do not exceed the recommended dosages, and take these medications with meals or snacks to avoid heartburn. It is wise to consult your physician prior to taking any medications to assure the medication is safe and appropriate for your condition, particularly if you are taking any other medications, prescription or otherwise.

## **COMMON TYPES OF INJURIES**

Sports medicine professionals divide injuries into two general categories, traumatic and overuse. You can think of traumatic injuries as those that are caused by a single event. Examples include an ankle sprain resulting from stepping into a hole while running or a bruise resulting from a collision with an object. Overuse injuries are not caused by a single event but rather by the accumulation of many small injuries. These small injuries would normally heal very quickly and you would hardly notice them. However, if you continue to use the injured area, the injury never heals properly and continues to worsen.<sup>47</sup>

## **TRAUMATIC INJURIES**

The most common traumatic injuries are strains, sprains, contusions, and blisters. Strains or muscle pulls result when muscles are overstretched. Depending on the severity, you might feel anything from minor pain all the way up to severe pain with discoloration and a bump at the injury site. Sprains are injuries to the ligaments around a joint. Depending on the amount of tissue involved, symptoms of a sprain may extend from mild pain to marked swelling, severe pain, and excessive movement (instability) of the joint. Immediate treatment for strains and sprains involves the RICE protocol—rest, ice, compression, elevation.

Contusions are generally caused by collisions between objects and parts of the body. The body area becomes discolored and you experience localized pain. The pain and discoloration are due to the collection of blood in the muscle and surrounding tissue. The blood comes from blood vessel breakage during and shortly after the collision. Immediate treatment again involves the RICE protocol.

Foot blisters are caused by friction as the foot moves very slightly in the shoe. Since friction increases with moisture, anything you can do to reduce sweat around the foot should reduce blisters.<sup>48</sup> A thin polyester liner sock worn next to the skin, coupled with a wool blend outer sock, reduces blister incidence, not only because of the extra padding but because it forces moisture away from the foot.<sup>49</sup> In addition, a common antiperspirant (aluminum chloride hexahydrate) effectively reduces blister incidence, probably because it reduces the amount of sweat forming in the first place.<sup>50</sup> To be most effective, the antiperspirant should be applied for 5 consecutive nights prior to activity. Thereafter, the antiperspirant need be applied only once or twice a week to maintain the effect. If you get a blister, puncture it to release the blister fluid using a needle that has been sterilized over an open flame. Keep the top of the blister intact if possible. It protects the tender, raw flesh underneath. If the top of the blister has torn off, keep the area clean and covered and watch for signs of infection (red color or red streaks). Seek medical care if you see infection.

Less common but very serious types of injury are fractures and dislocations. Fractures are broken bones; dislocations are separations of the joint. When these injuries occur, emergency medical personnel should be consulted immediately. Splinting (immobilization) of the affected area to avoid further injury is appropriate, but only trained personnel should perform this.

## **OVERUSE INJURIES**

Overuse injuries are much more common than traumatic injuries among physically active individuals. First aid treatment for all overuse injuries also follows the RICE protocol.

Bursitis is an inflammation of the fluid-filled sac that surrounds the joint and provides lubrication for movement. Normally there is pain as well as limitations in movement. Bursitis is often caused by acute or chronic mechanical irritation.

Tendinitis refers to an inflammation of the tendons, which hold the muscle to the bone. Although tendinitis can occur in almost any body location, one of the most common types is achilles tendinitis. This is often experienced as a painful burning sensation in the back of the lower leg, near the heel. The pain becomes most intense when the individual moves after being sedentary for a period of time and lessens with increased activity. The pain is presumably caused by tightening and inflammation of the large achilles tendon in the back of the leg. If the condition persists, a complete break of the tendon is possible, resulting in an inability to walk. Achilles tendon injuries commonly appear in older athletes.<sup>51</sup> These injuries can be quite disabling; therefore, appropriate care should be taken at the first sign of symptoms.

Plantar fasciitis, sometimes called painful heel syndrome, is an inflammation of the fibrous tissue on the bottom of the foot. It is believed to be caused by a tightening of this tissue. It is often felt as heel pain and is most pronounced when you have been inactive for a long period of time, especially on arising in the morning. Pain generally lessens after the first few steps.

Runner's knee is often felt as a pain in the area below or around the kneecap. The pain increases with activity, running downhill, going up or down stairs, or sitting for a long period of time. The knee may feel unstable or give way.

Stress fractures are small hairline fractures in the bone. Normally, bone responds to exercise stress by a process called remodeling, which involves strengthening bone by removing old bone and replacing it with new bone. New bone is deposited in locations that allow the body to best tolerate the new stress. In this process, the bone is temporarily weakened (by removal of old bone) before it is made stronger (by replacement with new bone). If excessive physical activity occurs while the bone is in the weakened condition, the bone may be injured by development of the hairline breaks. Most stress fractures occur in the lower extremities, especially in the lower leg and foot. While this type of injury is less common in older athletes, it is especially serious because it threatens the structural integrity of the body.<sup>52</sup> If you experience bone pain that does not go away in a few days or that worsens with exercise, you should consult a health care provider.

Shin splint is a vague term used to denote pain experienced in the front part of the lower leg. A number of areas may be involved including the bones, muscles, or blood vessels. Sometimes stress fractures to the shin bones are involved. At other times, swelling of the leg as a result of inflammation is the cause of the pain. At still other times, the pain may arise from damage to blood vessels.

## **INJURIES AMONG MATURE RECREATIONAL ATHLETES**

Surprisingly few studies have been devoted to injuries in older recreational athletes.<sup>53</sup> Thus a study by Dr. Gordon Matheson and his coworkers at the University of British Columbia is useful because it compared exercise injuries of those over 50 years of age with such injuries to those under 50.<sup>54</sup> The major finding of this study was that the types of injury and body locations where the injuries occurred were remarkably similar between the two age groups. The most common types of injuries were tendinitis, pain under the kneecap, sprains, and strains. The most common injury sites were the knee, foot, lower leg, ankle, and shoulder. These findings are similar to ours with regard to students at the Army War College, where we found that sprains, sprains, and tendinitis were common injuries and that the knee, foot, and shoulders were very common injury sites.<sup>55</sup>

However, some differences did exist between the older and younger individuals in Matheson's study. On the positive side, the older athletes had fewer stress fractures, sprains, and pain around the kneecap. On the negative side, the older athletes had a higher incidence of foot pain, plantar fasciitis, and damage to the cartilage of the knee. As one ages, the reduction in strength and flexibility may reduce the shock-absorbing capabilities of the foot, resulting in changes in this area that cause pain and increase the chance of injury.<sup>56</sup> Injury to the cartilage of the knee may be due to small tears of this tissue over time.

The incidence of osteoarthritis was also higher in the older athletes. Osteoarthritis is a degeneration of the shock-absorbing cartilage around the joint. As one ages, this cartilage

loses its elasticity and does not perform its shock-absorbing function quite as well because it becomes soft, frayed, and thinned. Other changes occur such as muscle weakness and an undesirable growth of new bone inside and around the joint.

It was once thought that osteoarthritis was caused by the high impact forces associated with some types of physical activity (e.g. running, racquetball, softball). To test this idea, a number of studies were conducted on runners from the 1970s onward. Drs. Richard Panush and Joseph Inzinna summarized 12 investigations involving over 1,500 individuals averaging 53 years of age who ran an average of 33 miles/week for about 16 years.<sup>57</sup> They found that runners did not develop premature degeneration of the joints when compared to nonrunners. But when they looked at studies on other activities like baseball, ballet, cycling, football, and gymnastics there was some suggestion that these activities may increase risk. Most of these latter studies, however, were based on anecdotal information or were not well conducted. Thus running itself does not seem to increase the risk of osteoarthritis, but we will have to await more information on other activities. Regular exercise is often recommended for individuals who have osteoarthritis, because it improves joint mobility and reduces the symptoms of pain and stiffness.<sup>58</sup>

## CONCLUSIONS

Most of the injuries you may experience will be due to training errors: training too long per session, too fast, or for too many days. Exercise physiology and sports medicine have made remarkable progress in the last 30 years in identifying injury risk factors and finding ways to speed healing. As a mature recreational athlete, you have gained a unique knowledge about the capabilities and limitations of *your* body. Think of yourself as an experiment of one person. Couple the knowledge from exercise physiology and sports medicine with your personal evaluation of how much physical activity is appropriate for you. Constantly adjust your physical activity based on the exercise and sports medicine knowledge you gain, how your body feels, and your personal evaluation of what works for you.

As an athlete, you may push your body a bit to improve more, test your limits, or train for a competition; however, your body will tell you through its pain mechanisms when you have pushed too far. If you do push too far, recognize what has happened and take the appropriate steps to heal properly. Listen to the wisdom of your body and the signals it provides and then adjust your training accordingly. But most importantly, enjoy the higher quality of life that goes with an active lifestyle.

## ENDNOTES

1. R. S. Paffenberger et al., "Physical Activity, All-Cause Mortality, and Longevity of College Alumni," *New England Journal of Medicine*, Vol. 314, 1986, pp. 605-613.
2. B. Sternfeld, "Cancer and the Protective Effect of Physical Activity: The Epidemiological Evidence," *Medicine and Science in Sports and Exercise*, Vol. 24, 1992, pp. 1195-1209.

3. K. E. Powell et al., "Physical Activity and Chronic Disease," *American Journal of Clinical Nutrition*, Vol. 49, 1998, pp. 999-1006.
4. J. J. Knapik et al., "An Investigation of Injuries Among Army Officers Attending the U.S. Army War College During Academic Year 1999," Aberdeen Proving Ground, MD: U.S. Army Center for Health Promotion and Preventive Medicine Epidemiological Consultation Report No. 29-HE-2682-99, 1999.
5. B. H. Jones, D. N. Cowan, and J. J. Knapik, "Exercise, Training, and Injuries," *Sports Medicine*, Vol. 18, 1994, pp. 202-214; J. P. Koplan et al., "An Epidemiological Study of the Benefits and Risks of Running," *Journal of the American Medical Association*, Vol. 16, 1977, pp. 31-36.
6. M. L. Pollock et al., "Effects of Frequency and Duration of Training on Attrition and Incidence of Injury," *Medicine and Science in Sports and Exercise*, Vol. 9, 1977, pp. 31-36.
7. L. I. Gardner et al., "Prevention of Lower Extremity Stress Fractures: A Controlled Trial of Shock Absorbent Insole," *American Journal of Public Health*, Vol. 78, 1988, pp. 1563-1566.
8. J. J. Knapik, et al., "Seasonal Variation in Injury Rates During a Standard Physical Activity Program," Submitted to *American Journal of Sports Medicine*, 2000.
9. B. H. Jones et al., "Epidemiology of Injuries Associated with Physical Training Among Young Men in the Army," *Medicine and Science in Sports and Exercise*, Vol. 25, 1993, pp. 197-203; and R.A. Shaffer et al., "Use of Simple Measures of Physical Activity to Predict Stress Fractures in Young Men Undergoing a Rigorous Training Program," *American Journal of Epidemiology*, Vol. 149, 1999, pp. 236-242.
10. B. H. Jones et al., "Intrinsic Risk Factors for Exercise-Related Injuries Among Male and Female Army Trainees," *American Journal of Sports Medicine*, Vol. 21, 1993, pp. 705-710; Jones et al., "Epidemiology of Injuries"; and J. J. Knapik et al., "Injury Incidence and Injury Risk Factors Among U.S. Army Basic Trainees at Ft. Jackson, SC," Aberdeen Proving Ground, MD: U.S. Army Center for Health Promotion and Preventive Medicine Epidemiological Consultation Report No. 29-HE-8370-99, 1999.
11. Jones et al., "Epidemiology of Injuries"; K. R. Kaufman et al., "The Effect of Foot Structure and Range of Motion on Musculoskeletal Overuse Injury," *American Journal of Sports Medicine*, Vol. 27, 2000, pp. 585-593; and J. J. Knapik et al., "Strength, Flexibility, and Athletic Injuries," *Sports Medicine*, Vol. 14, 1993, pp. 277-288.
12. W. H. Van Mechelen et al., "Prevention of Running Injuries by Warm-up, Cool-Down, and Stretching Exercises," *American Journal of Sports Medicine*, Vol. 21, 1993, pp. 711-719.
13. R. P. Pope et al., "A Randomized Trial of Preexercise Stretching for Prevention of Lower-Limb Injury," *Medicine and Science in Sports and Exercise*, Vol. 32, 2000, pp. 271-277.
14. M. R. Safran et al., "The Role of Warm-up in Muscular Injury Prevention," *American Journal of Sports Medicine*, Vol. 16, 1988, pp. 123-129; F. G. Shellock and W. E. Prentice, "Warm-up and Stretching for Improving Physical Performance and Prevention of Sports-related Injuries," *Sports Medicine*, Vol. 2, 1985, pp. 267-278; and I. B. Stewart and G. G. Sleivert, "The Effect of Warm-up Intensity on Range of Motion and Anaerobic Performance," *Journal of Orthopedic and Sports Physical Therapy*, Vol. 27, 1998, pp. 154-161.
15. Knapik et al., "An Investigation of Injuries."
16. J. Ekstrand and J. Gillquist, "The Avoidability of Soccer Injuries," *International Journal of Sports Medicine*, Vol. 4, 1983, pp. 124-128; and Jones et al., "Epidemiology of Injuries."
17. G. D. Rovere et al., "Retrospective Comparison of Taping and Ankle Stabilizers in Preventing Ankle Injuries," *American Journal of Sports Medicine*, Vol. 16, 1988, pp. 228-233; S. J. Sharpe, J. J. Knapik, and B. H. Jones, "Ankle Braces Effectively Reduce Recurrence of Ankle Sprains in Female Soccer Players," *Journal of*

*Athletic Training*, Vol. 32, 1997, pp. 21-24; and I. Surve et al., "A Five-fold Reduction in the Incidence of Recurrent Ankle Sprains in Soccer Players Using the Sports-stirrup Orthosis," *American Journal of Sports Medicine*, Vol. 22, 1994, pp. 601-606.

18. Jones et al., "Epidemiology of Injuries"; Knapik et al., "Injury Incidence and Injury Risk Factors"; A. Naus et al., "Work Injuries and Smoking," *Industrial Medicine and Surgery*, Vol. 35, 1966, pp. 880-881; and K. L. Reynolds et al., "Cigarette Smoking, Physical Fitness, and Injuries in Infantry Soldiers," *American Journal of Preventive Medicine*, Vol. 10, 1994, pp.145-150.

19. P. J. Amoroso et al., "Tobacco and Injuries: An Annotated Bibliography," Natick MA: U.S. Army Research Institute of Environmental Medicine Technical Report TN 96-1, 1996; J. J. Knapik, K. L. Reynolds, and J. Barson, "Influence of Antiperspirants on Foot Blisters Following Road Marching," Aberdeen Proving Ground, MD: U.S. Army Research Laboratory Technical Report ARL-TR-1333, 1997.

20. See endnote 4.

21. B. H. Jones, "Injuries Among Men and Women in Gender-integrated BCT Units, Ft Leonard Wood, 1995," *Medical Surveillance Monthly Report*, Vol. 2, 1996, pp. 2-3, 7-8; Jones et al., "Intrinsic Risk Factor for Exercise Related Injuries"; Knapik et al., "Injury Incidence and Injury Risk Factors"; and D. M. Koala, "Nature and Causes of Injuries in Women Resulting from an Endurance Training Program," *American Journal of Sports Medicine*, Vol. 8, 1980, pp. 265-269.

22. K. S. Clarke and W. E. Buckley, "Women's Injuries in Intercollegiate Sports," *American Journal of Sports Medicine*, Vol. 8, 1980, pp. 187-191; R. R. Lanese et al., "Injury and Disability in Matched Men's and Women's Intercollegiate Sports," *American Journal of Public Health*, Vol. 80, 1990, pp. 1459-1462; R.A. Shively, W. A. Grana, and D. Ellis, "High School Sports Injuries," *Physician and Sportsmedicine*, Vol. 9, 1981, pp. 46-50; and S. H. Splain and A. Rolnick, "Sports Injuries at a Non-Scholarship University," *Physician and Sportsmedicine*, Vol. 12, 1984, pp. 55-60.

23. J. J. Knapik et al., "Physical Fitness, Age, and Injury Incidence in Infantry Soldiers," *Journal of Occupational Medicine*, Vol. 35, 1993, pp. 598-603; J. P. Tomlinson, W. M. Lednar, and J. D. Jackson, "Risk of Injury in Soldiers," *Military Medicine*, Vol. 152, 1987, pp. 60-64; and D. K. Wagener and D. W. Winn, "Injuries in Working Populations: Black-White Differences," *American Journal of Public Health*, Vol. 821, 1991, pp. 1408-1413.

24. D. N. Cowan, B. H. Jones, and J. R. Robinson, "Foot Morphologic Characteristics and Risk of Exercise-related Injuries," *Archive of Family Medicine*, Vol. 2, 1993, pp. 773-777; and Kaufman et al.

25. D. N. Cowan et al., "Lower Limb Morphology and Risk of Overuse Injury Among Male Infantry Trainees," *Medicine and Science in Sports and Exercise*, Vol. 28, 1996, pp. 945-952.

26. W. J. Kraemer, M. R. Deschenes, and S. J. Fleck, "Physiological Adaptations to Resistance Exercise: Implications for Athletic Conditioning," *Sports Medicine*, Vol. 6, 1988, pp. 246-256; W. D. McArdle, F.I. Katch, and V.L. Katch, *Exercise Physiology: Energy, Nutrition, and Human Performance*, Philadelphia: Lea and Febiger, 1986; and B. L. Specker, "Evidence for an Interaction Between Calcium Intake and Physical Activity on Change in Bone Mineral Density," *Journal of Bone Mineral Research*, Vol. 11, 1996, pp. 1539-1544.

27. E. C. Frederick, *The Running Body*, Mountain View, CA: World Publications, 1973.

28. D. Wathen, "Periodization: Concepts and Application," *Essentials of Strength Conditioning*, ed. T. R. Baechle, 1994.

29. Pollock et al.



30. D. C. Thompson and M. O. Patterson, "Cycle Helmets and Prevention of Injuries," *Recommendations for Competitive Sports*, *Sports Medicine*, Vol. 25, 1998, pp. 213-219.
31. Centers for Disease Control and Prevention, "Injury Control Recommendations: Bicycle Helmets," *Morbidity and Mortality Weekly Report*, Vol. 44, RR-1, 1995, pp. 1-17; "CPSC Issues New Safety Standards for Bike Helmets," U.S. Consumer Product Safety Commission, Office of Information and Public Affairs Release 98-062, 1998; Thompson and Patterson.
32. T. J. Pashby, "Eye Injuries in Canadian Hockey: Phase II," *Canadian Medical Association Journal*, Vol. 17, 1997, pp. 670-678; and D. A. Webster, G. V. Boyless, and J. A. Spandero, "Head and Face Injuries in Scholastic Women's Lacrosse With and Without Eyewear," *Medicine and Science in Sports and Exercise*, Vol. 31, 1997, pp. 938-941.
33. S. M. Napier et al., "Eye Injury in Athletics and Recreation," *Survey of Ophthalmology*, Vol. 41, 1996, pp. 229-244.
34. T. H. Ellis, "Sports Protective Equipment," *Primary Care*, Vol. 18, 1991, pp. 889-921; and P. F. Vinger, "Injury Prevention: Where Do We Go from Here?" *Journal of American Optometry Association*, Vol. 70, 1999, pp. 87-98.
35. R. A. Schieber and C. M. Branche-Dorsey, "In-line Skating Injuries: Epidemiology and Recommendations for Prevention," *Sports Medicine*, Vol. 19, 1995, pp. 427-432.
36. D. Lorenzten and L. Lawson, "Selected Sports Bras: A Biochemical Analysis of Breast Motion While Jogging," *Physician and Sportsmedicine*, Vol. 15, No. 5, 1987, pp. 128-139.
37. Lorenzten and Lawson; and B. R. Mason, K. A. Page, and K. Fallon, "An Analysis of Movement and Discomfort of the Female Breast During Exercise and the Effect of Breast Support in Three Cases," *Journal of Science and Medicine in Sports*, Vol. 2, 1999, pp. 134-144.
38. K. A. Page and J. R. Steele, "Breast Motion and Sports Brassiere Design: Implications for Future Research," *Sports Medicine*, Vol. 27, 1999, pp. 205-211; and B. Stamford, "Sports Bras and Briefs: Choosing Good Athletic Support," *Physician and Sportsmedicine*, Vol. 24, 1996, pp. 99-100.
39. D. H. Janda, F. M. Hankin, and E. M. Wojtys, "Softball Injuries: Cost, Cause, and Prevention," *American Family Physician*, Vol. 33, 1986, pp. 143-144; and M.T. Nadeau et al., "The Prevention of Softball Injuries: The Experience at Yokota," *Military Medicine*, Vol. 155, 1990, pp. 3-5.
40. D. H. Janda, D. E. Wild, and R. N. Hensinger, "Softball Injuries: Aetiology and Prevention," *Sports Medicine*, Vol. 13, 1997, pp. 285-291; and D. H. Janda et al., "A Three-phase Analysis of the Prevention of Recreational Softball Injuries," *American Journal of Sports Medicine*, Vol. 18, 1990, pp. 632-635.
41. R. A. Sendre et al., "Use of the Hollywood Impact Base and Standard Base to Reduce Sliding and Base Running Injuries in Baseball and Softball," *American Journal of Sports Medicine*, Vol. 22, 1994, pp. 450-453.
42. B. Gundewall et al., "Primary Prevention of Back Symptoms and Absence from Work: A Prospective Randomized Study Among Hospital Employees," *Spine*, Vol. 18, 1993, pp. 587-594; F. R. Hansen et al., "Intensive, Dynamic Back Muscle Exercises, Conventional Physiotherapy, or Placebo Control Treatment of Low Back Pain— A Randomized, Observer Blind Trial," *Spine*, Vol. 18, 1993, pp. 98-108; B. Nelson et al., "The Clinical Effects of Intensive, Specific Exercise on Chronic Low Back Pain: A Controlled Study of 895 Consecutive Patients with One Year Follow-up," *Orthopedics*, Vol. 18, 1995, pp. 971-981; P.B. O'Sullivan et al., "Evaluation of Specific Stabilizing Exercise in the Treatment of Chronic Low Back Pain with Radiologic Diagnosis of Spondylosis or Spondylolisthesis," *Spine*, Vol. 22, 1997, pp. 2959-2967; and J. A. Saal, "Nonoperative Treatment of Herniated Lumbar Intervertebral Disc with Radiculopathy: An Outcome Study," *Spine*, Vol. 14, 1989, pp. 431-437.

43. D. M. Kahler, "Low Back Pain in Athletes," *Journal of Sports Rehabilitation*, Vol. 2, 1993, pp. 63-78.
44. J. W. Frymoyer and W.L. Cats-Baril, "An Overview of the Incidences and Costs of Low Back Pain," *Orthopedic Clinics of North America*, Vol.22, 1991, pp. 263-271; D. M. Kahler, "Low Back Pain in Athletes," *Journal of Sports Rehabilitation*, Vol. 2, 1993, pp. 63-78; A. L. Nachemson, "The Lumbar Spine: an Orthopedic Challenge," *Spine*, Vol. 1, 1976, pp. 59-71; and D. H. Saunders, *Evaluation, Treatment, and Prevention of Musculoskeletal Disorders*, Minneapolis, MN: Viking Press, 1985.
45. D. Wohlfahrt et al., "The Relationship Between the Dynamic and Static Function of Abdominal Muscles," *Australian Journal Physiotherapy*, Vol. 39, 1993, pp. 9-13.
46. B. H. Jones et al., "Exercise-related Musculoskeletal Injuries: Risks, Prevention, and Care," *ACSM's Resource Manual for Guidelines for Exercise Testing and Prescription*, eds. J. L. Durstine et al., American College for Sports Medicine, 1993, pp. 378-393.
47. D. D. Arnheim and W. E. Prentice, *Principles of Athletic Training*, St. Louis: Mosby Year Book, 1993; Jones et al., "Exercise-related Musculoskeletal Injuries"; and A. F. Morris, *Sports Medicine Handbook*, Dubuque, IA: W.C. Brown, 1984.
48. W. A. Akers and M. B. Sulzberger, "The Friction Blister," *Military Medicine*, Vol. 137, 1972, pp. 1-7.
49. J. J. Knapik et al., "Influence of Boot Sock Systems on Frequency and Severity of Foot Blisters," *Military Medicine*, Vol. 161, 1996, pp. 594-598.
50. J. J. Knapik, K. Reynolds, and J. Barson, "Influence of An Antiperspirant on Foot Blister Incidence During Cross Country Hiking," *Journal of the American Academy of Dermatology*, Vol. 39, 1998, pp. 202-206.
51. M. Kallinen and A. Markku, "Aging, Physical Activity, and Sports Injury: An Overview of Common Sports Injury in the Elderly," *Sports Medicine*, Vol. 20, 1995, pp. 41-52.
52. G. O. Matheson et al., "Musculoskeletal Injuries Associated with Physical Activity in Older Adults," *Medical Science and Sports Exercise*, Vol. 21, 1989, pp. 379-385.
53. Kallinen and Markku.
54. Matheson et al.
55. Knapik et al., "An Investigation of Injuries."
56. D. A. Brown and W. C. Miller, "Normative Data for Strength and Flexibility of Women Throughout Life," *European Journal of Applied Physiology*, Vol. 78, 1998, pp. 72-82; and M. J. G. Van Heuvelen et al., "Physical Fitness Related to Age and Physical Activity in Older Persons," *Medicine and Science in Sports and Exercise*, Vol. 30, 1998, pp. 424-441.
57. R. S. Panush and J. D. Inzinna, "Recreational Activities and Degenerative Joint Disease," *Sports Medicine*, Vol. 17, 1994, pp. 1-5.
58. N. A. DiNubile, "Osteoarthritis: How to Make Exercise a Part of Your Treatment Plan," *Physician and Sportsmedicine*, Vol. 25, No. 7, 1997, pp. 47-56.

## CHAPTER 8

### EATING FOR PERFORMANCE AND HEALTH: THE NUTRITION CONNECTION

Lori D. Hennessy and Gaston P. Bathalon

Are you eating the right foods to fuel your fast-paced, high-performance life-style? Every day is a race against the clock to accomplish countless tasks at work and home, within the community, and with family and friends. There is little time for anything else, including healthy eating! Your hectic life-style places strenuous demands on you. This chapter provides you with practical advice on how to eat to improve performance and health.

#### EATING BASICS FOR MAXIMUM PERFORMANCE

What and when you eat can significantly affect how you feel, thus impacting your performance. There are three eating basics you must practice to fuel your body and mind for success:

- **Eat a variety of foods.** Your body needs more than 40 different nutrients daily. Eating the same foods meal after meal and day after day increases the chance that you are not getting the right mix of nutrients for maximal performance. There is no one magic food that fuels your body because each food provides different nutrients in varying quantities.
- **Balance the foods you eat over several days.** In your hectic life, it may not be realistic to eat healthfully every single day. Be sensible and consider eating healthfully most of the time. For weight control, it is important to balance your caloric intake with your physical activity. To maintain weight, eat only the calories your body requires.
- **Eat and enjoy all foods in moderation.** All foods can be part of a healthy diet. The secret is not to indulge in high-calorie foods too often or in super-size portions. Super-size portions can lead to super-size weight gain, especially if you are not balancing your caloric intake with your caloric expenditure.

#### WHAT'S IN A FOOD?

The key to successful, high-energy performance is to prevent excessive hunger. Eating at least three meals during your grueling day fuels working muscles, to include your brain. Additionally, it is absolutely critical to fuel your body with the right nutrients. There are six classes of nutrients that perform or assist with specific bodily functions, cumulatively

comprising a vital factor in maintaining your performance and health. They are carbohydrates, protein, fat, water, vitamins, and minerals. Each nutrient is discussed in detail.

**Carbohydrates: Your #1 Performance Nutrient.** Carbohydrates are super fuel. They are your most important nutrient for achieving and maintaining maximal performance and stamina. Carbohydrates are either simple or complex and are found in greatest amounts in fruits, vegetables, and grains. Simple carbohydrates, also called simple sugars, include honey, table sugar, molasses, and foods containing added sugars such as non-diet sodas, desserts, and candy. Since simple sugars supply the most basic form of carbohydrates, they require very little digestion. Once consumed, they enter the bloodstream immediately and circulate as blood sugar, supplying you with energy to fuel both your body and your brain.

Complex carbohydrates, or starches, include fruits, vegetables, rice, pasta, potatoes, breads, cereals, and other grains. During digestion, they are broken down into glucose, a simple sugar. This process requires a few hours, which is why complex carbohydrates are not available for immediate energy like simple carbohydrates. Once broken down, the glucose units move throughout the body and are either used instantly or stored for later use.

The storage form of carbohydrate is glycogen. A typical 150-pound man stores about 1,800 calories in the form of glycogen. Table 1 lists glycogen storage sites, the approximate caloric content of the stored glycogen, and the corresponding purpose.<sup>1</sup>

<b>Storage Site</b>	<b>Calories</b>	<b>Purpose</b>
Muscle	1,400	Fuel muscles
Liver	320	Fuel muscles & brain
Blood	80	Fuel brain

**Table 1.**

Carbohydrates play a critical role in fueling both muscle and brain power. In fact, your brain uses only carbohydrates for energy. When you deplete your carbohydrate stores, you may feel fatigued, light-headed, and unable to concentrate as effectively, or you may lose motivation to continue a mental or physical activity. A similar reaction may occur when you skip breakfast and lunch. To maximize your performance during hectic, mind-stressing days, 50-60% of your caloric intake should come from carbohydrate-containing foods. A few days of little or no carbohydrates can deplete glycogen stores, ultimately degrading your physical and mental performance.

Carbohydrates have been the center of controversy for several years. Supporters of low-carbohydrate diets claim that carbohydrates are converted to fat and cause weight gain.

This claim is unwarranted. Carbohydrates have four calories per gram and are not stored as body fat unless you eat more total calories than your body requires. We shall return to this subject later.

**Protein: The Building Block for Winning Performance.** Protein is found in every cell of your body for building and repairing muscles and tissues, making hormones and chemicals for your body and brain, and supplying energy. Therefore, protein is needed every day, throughout the day, to maintain top performance. Protein differs from carbohydrates in that it cannot be stored for later use. After eating protein-containing foods such as meat, fish, milk, dry beans, nuts, or eggs, your body breaks them down into component parts called amino acids. These amino acids enter your bloodstream and are used immediately.

If you do not eat enough carbohydrates to maintain your glycogen stores or if you do not consume enough calories, your body will use amino acids (protein) for fuel.<sup>2</sup> However, this process is used only as an emergency back-up to supply energy to working muscles and your brain. The drawback is that critical amino acids are shunted away from their primary roles, which can lead to diminished performance and a weakened immune system susceptible to colds and other viruses.

*Are you eating enough protein to power your performance?* Table 2 lists recommended protein needs for individuals by activity level.<sup>3</sup>

Based on these categories, you can calculate your protein requirements according to the example in the box below:

Status and Activity Level	Grams of Protein Per Pound of Body Weight
Sedentary Adults	0.36
Recreational Exerciser, Adult	0.5 - 0.75
Competitive Athlete, Adult	0.6 - 0.9
Growing Teenage Athlete	0.8 - 0.9
Adult Building Muscle Mass	0.7 - 0.9
Athlete Restricting Calories	0.8 - 0.9
Maximum Usable Amount for Adults	0.9

**Table 2.**

Example: A 170-pound person who competes in marathons (i.e. competitive adult athlete) needs 102-153 grams of protein/day:

$$170 \times 0.6 = 102 \text{ grams minimum}$$

$$170 \times 0.9 = 153 \text{ grams maximum}$$

A 170-pound recreational exerciser who exercises 3-5 times/week needs 85-128 grams a day:

$$170 \times 0.5 = 85 \text{ grams minimum}$$

$$170 \times .75 = 128 \text{ grams maximum}$$

In a survey conducted by the Military Family Institute, 15% of each age group surveyed, including military and civilian, do not exercise.<sup>4</sup> Yet, many Americans consume 1½ to 2 times the Recommended Dietary Allowance (RDA) for protein, which is 0.36 grams per pound of body weight. Busy schedules often lead people to snack on carbohydrates throughout the day with little or no protein consumed until the evening meal. Saving your protein intake for the end of the day may actually induce drowsiness, especially if you limit your food intake primarily to carbohydrates during the day. The neurotransmitter responsible for a drowsy feeling is serotonin, which is produced when you eat carbohydrate-rich foods such as pasta, bread, cereal, pretzels, and popcorn. On the other hand, the neurotransmitters norepinephrine and dopamine produce an energizing effect that helps increase your alertness and motivation. Tyrosine is the amino acid protein that produces these substances. Your best sources of tyrosine are low-fat protein-containing foods such as lean chicken, beef, or turkey, dry beans, tofu, peanut butter, milk, and yogurt. See Table 3 below.

<b>Food (amount)</b>	<b>Protein (grams)</b>
1 cup milk/yogurt	8
3 oz meat/fish	21-25
2 tbsp peanut butter	8
2 eggs	14
½ cup dry beans	7
¼ cake tofu	10
¼ cup powdered milk	11

**Table 3.**

To minimize carbohydrates' potential drowsy effects and achieve peak physical and mental performance, consume both protein- and carbohydrate-containing foods for meals and

snacks. Contrary to popular belief, eating excess protein does not improve performance, build bigger and stronger muscles, or aid in weight loss. In fact, whether it is from food or supplements, excess protein can be harmful. Urea, a by-product of protein break-down, can reach dangerous levels in the bloodstream if it is not excreted. To prevent urea toxicity, your kidneys have to work harder to filter blood and generate more urine for excretion. Ingestion of excessive quantities of protein over time can potentially trigger kidney complications due to the extra stress placed on them.

Like carbohydrate, protein has four calories per gram. Ten to 15% of your calories should come from protein. For a typical healthy person, eating four to seven ounces of protein-rich food daily is usually enough to satisfy protein requirements. When you eat more protein than what you need, your body stores the excess as fat, not muscle.

**Fat: An Essential Flavor Nutrient.** Fat is a nutrient often misunderstood and shunned, yet likely over-consumed despite our fat-phobic culture. However, in spite of its bad reputation, fat is needed for many functions such as meeting essential nutritional requirements, providing insulation and protection for vital organs, and providing energy for both low-intensity activity and exercise lasting more than 30 minutes.

For top performance and health, 20 to 30% of your calories should come from fat. Unfortunately, many Americans consume more than this amount, which can lead to obesity, heart disease, and certain cancers. In addition, too much fat may mean that you are not fueling your body with other high-energy nutrients like carbohydrates, protein, and essential vitamins and minerals. Not only can a high-fat diet jeopardize your health, it can also pack on the pounds because fat is calorie-rich. Fat has nine calories per gram, more than twice as many calories as carbohydrates and protein. Choosing lower-fat versions of some foods may reduce your caloric intake, assuming that you do not increase the portion size. In addition, your body easily stores excess fat calories as body fat, whereas you are more likely to burn off excess carbohydrate calories.

*How much fat is enough?* A typical 150-pound man stores 1,800 calories in the form of carbohydrates. This same person stores 60,000 to 100,000 calories as fat—enough energy to fuel several marathon workdays. Table 4 recapitulates the calorie content and recommended dietary percentages for carbohydrates, protein, and fat.

Nutrient	Calories per Gram	Recommended Percentage in Diet
Carbohydrate	4	50 - 60%
Protein	4	10 - 15%
Fat	9	20 - 30%

**Table 4.**

The amount of fat to eat depends on your daily caloric intake. For example, if you eat 2,000 calories a day, then you should eat from 400 (20% of 2,000) to 600 (30% of 2,000) fat calories per day. Assuming you are using the upper range of 600 fat calories per day, the method for calculating the corresponding number of fat grams is shown in the box below. Later, we shall discuss how to calculate daily caloric requirements.

$2,000 \text{ calories} \times .30 \text{ (30\%)} = 600 \text{ calories from fat}$

Divide calories from fat by 9 since 1 gram of fat has 9 calories.

$600 \text{ calories} \div 9 \text{ calories per gram} = 67 \text{ grams of fat for a 2,000-calorie diet containing 30\% fat}$

**Water: Your #1 Fluid Choice.** Water is a critical nutrient that your body relies on daily. In fact, you cannot live without water for more than 3 to 4 days. Fifty to 65% of your body is made up of water; therefore, water plays an important role in most human physiological activities. Water carries nutrients to working cells and muscles, transports waste products out of your body in the form of urine, lubricates your joints, and helps maintain your body temperature. Feeling tired, headachy, and dizzy, and lacking your usual concentration and motivation, can indicate dehydration.

If you fuel your day with caffeinated beverages, breathe dry air-conditioned or heated air at work, or perform exercise during the day, you are at risk for dehydration. To rev up your concentration and motivation, drink at least eight to ten 8-ounce glasses of water every day. Your brain is 75% water; therefore, even moderate dehydration can degrade brainpower. Yet another good reason to drink up is that men who drink six or more cups of water a day have half the risk of getting bladder cancer compared to men who drink less than one cup a day.<sup>5</sup> The good news is that your fluid intake does not have to be limited to water. Juice, milk, soup, and other non-caffeinated beverages count toward your total fluid intake. You may not want to include caffeinated beverages as part of your fluid intake because caffeine acts like a diuretic, which works to rid your body of crucial water. To maintain adequate hydration, consider drinking a glass of water for every one to two cups of caffeine-containing beverages consumed.

*How do you know if you are adequately hydrated?* Your urine should be pale yellow or clear in color. Dark, concentrated urine with a strong smell is a clue that you need to drink water. Some vitamin and mineral supplements can color your urine also. Other signs of dehydration include thirst, dizziness, fatigue, flushed skin, headache, loss of appetite, and weakness.

Begin your day with 8 to 16 ounces of water and replenish your body and brain with water often throughout the day. When exercising or traveling, you need even more than the recommended eight to ten glasses a day. For a successful, high-energy day, follow the recommendations in Table 5 below.



<b>Less Active</b>	Drink 8-10 cups a day (1 cup=8oz)
<b>More Active</b>	Drink at least 10-12 cups a day
<b>Before Exercise</b>	Drink at least 16 oz
<b>During Exercise</b>	Drink 4-8 oz every 15-20 minutes
<b>After Exercise</b>	Drink at least 24 oz or 1-2 cups for every pound lost during exercise

**Table 5.**

**Vitamins and Minerals: Your Sparkplugs for Performance.** People who take a vitamin or mineral supplement instead of eating breakfast to energize their day are doing little to enhance energy levels. The reason is that energy is obtained from calories, which vitamin or mineral supplements do not provide. A vitamin or mineral capsule does, however, provide you with other important nutrients that may be lacking as a result of your less-than-perfect eating habits. Vitamins regulate all body processes, such as bone growth and maintenance of healthy skin. Without them, your body would not be able to activate carbohydrate, fat, and protein for energy. Minerals assist in regulating water balance and providing structure to bones and teeth.

Although vitamins and minerals do not directly provide energy in the form of calories, they play an extremely important role in generating energy for everything you do. Vitamins and minerals are like sparkplugs in your car's engine; you cannot get started without them. However, a common misconception is that the more vitamins and minerals you take, the more energy produced. This is not true as there is a very limited amount needed for this role. If through food or supplementation, you consume more vitamins or minerals than you need, the kidneys excrete the excess, except for fat-soluble vitamins A, D, E, and K.

Although you cannot live without vitamins and minerals, most people get enough through a variety of nutrient-dense foods. Table 6 shows 10 specific food amounts comprising a 1,200-calorie diet that together would provide most people with 100% of the RDA for each vitamin.

There are some situations that may increase your vitamin or mineral requirements. Healthy people who may benefit from vitamin or mineral supplements are:

- Women with heavy menstrual flow

- Pregnant or breast-feeding women
- Menopausal women
- Individuals on low calorie diets (less than 1,200 calories/day)
- Vegetarians
- Individuals with limited milk intake
- Anyone who is unable or unwilling to consume a healthy diet regularly

If you feel that you may benefit from vitamin or mineral supplementation, it is best to discuss this with your doctor or registered dietitian.

Ten Foods Together Providing at Least 100% of the RDA for Each Vitamin
2 cups fortified milk
3 oz chicken breast
3 oz tuna fish canned in water
1 medium carrot
1 stalk broccoli
1 orange
1 tbsp margarine
½ cup cauliflower
4 slices wheat bread
2 oz cereal

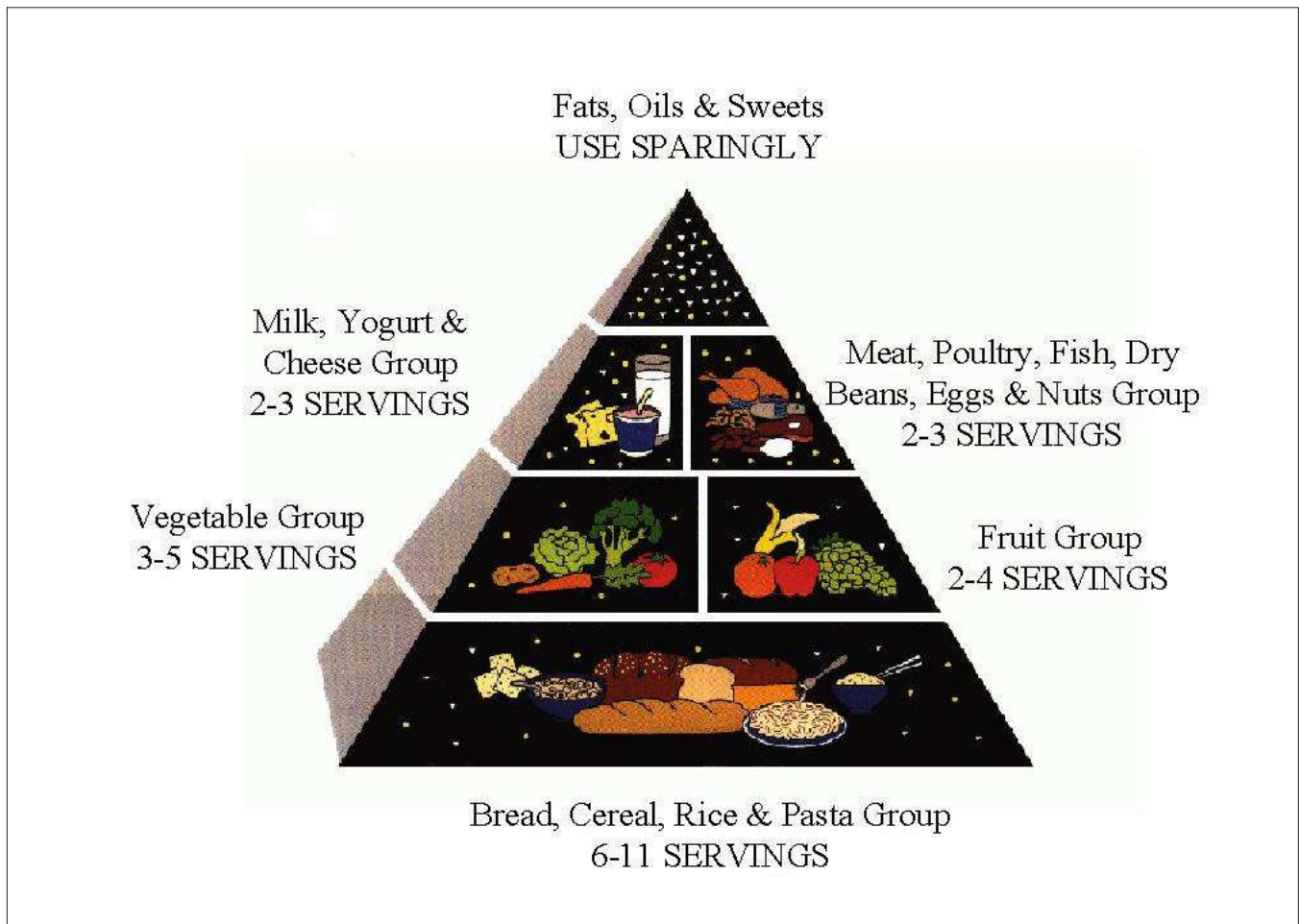
**Table 6.**

## THE FOOD PYRAMID: YOUR GUIDE TO PERFORMANCE EATING

Shown below in Figure 1 is the Food Pyramid. Use the Pyramid as your personal nutrition guide to help you eat a balanced diet that will not only fuel your body and mind, but also add years to your life. Eating the minimum recommended servings from each food group provides approximately 1,600 calories a day, while eating the maximum servings provides 2,800 calories. A confusing concept about the Food Pyramid is the serving size. We live in a world of super-sizes and mega-deals in which *actual* food servings are often three to four times the serving size employed by the U.S. Department of Agriculture (USDA) in designing the Food Pyramid. Table 7 below shows what several typical food units or portions available in home and restaurant are actually equivalent to in terms of Pyramid servings. See Appendix A for a list of Pyramid serving sizes for all food groups.

## EXPLORING THE FOOD PYRAMID

**Bread, Cereal, Rice, and Pasta Group.** This group forms the foundation of the Pyramid and thus the foundation of a healthy diet. Foods in this group provide high-energy complex carbohydrates and beneficial vitamins, minerals, and fiber, especially if the food is whole-grain. Foods from this group are generally low in fat, unless you add butter, margarine, oil, or other fats to them. To obtain high-energy, nutrient-packed carbohydrates, make sure that at least half of the foods consumed from this group are whole-grain or whole-wheat (fiber is discussed later).



**Figure 1. The Food Pyramid.**

It is easy for people with hectic schedules to munch through the day on carbohydrates while missing out on other nutrients. *Here are tips for eating adequate complex carbohydrates each day:*

- Eat 1 to 2 cups of whole-grain cereal for breakfast or for a mid-morning snack.

- Eat half of a large bagel or super-sized muffin and save the other half for later or share with a friend.
- Make a sandwich from whole-grain bread, such as whole wheat or pita bread.
- Snack on a serving of whole-grain crackers like Triscuits.
- Read nutrition labels for the serving size and eat 1 or 2 servings, not 3 to 5 servings.
- Stop yourself from eating the entire bag of pretzels or popcorn during the day. Remove 1 or 2 servings, put the bag away, and eat other foods to fuel your day.

Food Unit	Number of Pyramid Servings
1 deli bagel	4-5
1 restaurant portion of spaghetti	4-6
1 large sub roll	3-4
1 hamburger bun	2
1 typical bowl of cereal	2-3

**Table 7.**

**Fruits and Vegetables.** The fruit and vegetable groups are on the next layer of the pyramid. For optimal health and disease prevention, the National Cancer Institute and the USDA recommend that everyone eat at least five servings of fruits and/or vegetables a day. Yet, the Centers for Disease Control and Prevention (CDC) report that only 27% of women and 19% of men eat five or more servings daily.

Fruits and vegetables are packed with disease-fighting phytochemicals, vitamins, minerals, carbohydrates, and fiber. Phytochemicals are naturally-occurring substances, such as lycopene, carotenoids, and isoflavones that are found in plants. Their exact role in health promotion is uncertain; however, certain phytochemicals may help protect against some cancers, heart disease, and other chronic conditions. Another benefit of fruits and vegetables is that most of them do not contain fat unless it is added, and are lowest in calories when compared to other foods.

The number one change that most people should make in their eating habits is to consume more fruits and vegetables. *Here are tips to help you consume at least five servings a day:*

- Eat fruit or drink fruit juice with breakfast or snacks.

- Keep a stash of juice boxes, dried fruit, and canned fruit at work, in your suitcase, or in the car.
- Drink a fruit smoothie made from fresh fruit.
- Eat 1 to 2 servings of vegetables with your lunch. Bring fresh vegetables or order a side salad instead of fries with your sandwich.
- Eat your vegetables alone or, for added flavor, eat vegetables with low-fat dip or salad dressing. Eating vegetables with a little fat is better than eating none at all.
- Stock frozen vegetables at home. Microwave or steam them for a few minutes, and mix with pasta, toss with salad, or eat plain.
- Add vegetables to canned soups, pizza, or leftover pasta dishes.
- To save time, buy ready-to-eat fruits and vegetables.

### Milk & Soda Consumption

1970s: Teenagers drank twice as much milk as soda.

1990s: Teenagers drank twice as much soda as milk.

An average teenage girl gets 40% less calcium than she needs.

**Milk, Yogurt, and Cheese.** Dairy products comprise the third layer of the pyramid. Dairy foods provide you with a good source of protein and are some of the best sources of calcium and vitamins A and D. These foods can be high in fat and calories, however, so choose low-fat or fat-free dairy products more often. For the alarming decline in milk consumption by teenagers, see box to the upper right.<sup>6</sup>

Consuming enough dairy products, at least two to three servings daily, is your strongest safeguard against weak bones and the risk of bone fractures associated with osteoporosis. This is especially important for women who are going through or have been through menopause. *Here is how to sneak low-fat dairy products into your hectic day:*

- Eat cereal and milk with breakfast. Stock these foods at the office.
- Prepare oatmeal with milk instead of water.
- Eat low-fat yogurt with lunch or snacks. Add fruit, jams, jellies, or cereal to plain yogurt to create tasty flavors and textures.
- Drink calcium-fortified juice. Stash juice boxes at the office, in the car, or in your suitcase.
- Eat calcium-fortified cottage cheese.
- Eat low-fat cheese and crackers; string cheese travels well.

- Drink low-fat or skim milk with meals or snacks.
- Drink chocolate milk if you do not like the taste of white milk.
- Drink hot cocoa made with milk instead of water.

If you experience abdominal pain, bloating, nausea, cramping, or diarrhea after consuming dairy products, you may be lactose-intolerant. This is a condition in which your body cannot break down lactose (milk sugar) into small digestible parts. If you experience one or more of these symptoms after consumption of dairy products, see your doctor for a medical diagnosis.

Many people who are lactose-intolerant can consume lactose-containing foods. The key is knowing which foods contain lactose and how much lactose you can tolerate without experiencing an adverse reaction. Appendix B provides a list of lactose-containing foods and their amounts of lactose. *Here are some tips for lactose-intolerant individuals:*

- Drink lactose-reduced or lactose-free milk and other dairy products.
- Add lactase enzymes to milk before drinking it.
- Experiment with small amounts of lactose-containing food.
- Increase portion gradually to test your tolerance.
- Eat lactose-containing foods as part of a meal and not alone.
- Eat smaller, more frequent portions of lactose-rich foods.
- Try dairy foods made with active cultures (yogurt/buttermilk).
- Choose calcium-rich foods that are naturally lower in lactose (Swiss, Colby, parmesan, and cheddar cheese).

**Meat, Poultry, Fish, Dry Beans, Eggs, and Nuts.** The Food Pyramid's second food group found on the third layer consists of meat, chicken, turkey, pork, fish, seafood, wild game, dry beans, eggs, tofu, peanut butter, and nuts. In addition to providing protein, foods in this group also supply varying amounts of iron, zinc, and B vitamins—all of which are important to keep your body functioning at its maximum potential.

Darker-colored animal meats like beef, liver, and dark poultry meat are especially good sources of iron, the mineral that helps carry oxygen to working cells. If you are anemic or have insufficient iron, cells do not have as much oxygen as they should, and you may feel sluggish and tired. Eating enough iron-rich food is critical to brainpower since the brain requires the highest level of iron and oxygen of any organ. See Appendix C for a list of iron-rich foods.

Dry beans, also called legumes and lentils, are plant sources of protein and include kidney, pinto, navy, and soybeans. In addition to protein, these foods supply complex carbohydrates, fiber, and disease-fighting phytochemicals. They are also cholesterol-free and nearly fat-free. Nuts and peanut butter are excellent protein sources too, but they are higher in calories and fat—mostly heart-healthy unsaturated fat—so consume them in moderation. *Here are some practical tips for consuming your daily protein quota:*

- Limit your meat portion per meal to no more than 3 ounces, which is the size of a deck of cards.
- To distribute protein intake throughout the day, consider eating a small to moderate portion of protein-containing food with most or all of your meals and snacks.
- Toss a salad with chunks of chicken or tuna, a spoonful of garbanzo beans (chick-peas), or a dusting of nuts.
- Spread a thin layer of peanut butter on your toast, muffin, or bagel.
- Occasionally, eat eggs instead of meat. To control blood cholesterol levels, limit egg yolks to no more than 4 per week. Egg whites can be consumed in unlimited quantities.
- Enjoy a fish-containing meal at least once a week. Eat broiled, grilled, or baked fish, instead of fried fish.
- Make beans the main entrée of your meal a few times a week.
- Marinate firm tofu in your favorite marinade (it absorbs the marinade's flavors) and stir-fry with vegetables.
- Keep a small container of mixed nuts, like almonds, walnuts, and cashews, at work for an energizing afternoon snack. Beware of the calories from nuts since they add up quickly. A small handful supplies 170 to 250 calories and 14 to 21 grams of fat - most of them unsaturated.

**The Pyramid Tip.** Foods at the tip of the Pyramid should be consumed in small amounts to add flavor and enjoyment to meals and snacks. This group includes such foods as salad dressing, oil, butter, margarine, gravy, cream cheese, sour cream, sugar, soda, fruit drink and punch, jam and jelly, candy, chocolate, and gelatin. Many of these foods are empty calories—supplying a significant amount of calories without many, if any, beneficial nutrients. *Here are some tips on how to enjoy these foods in moderation:*

- Limit salad dressings to 1 - 2 tablespoons, or switch to low-fat and fat-free brands.
- Spread butter and margarine thinly.

- Try low-fat versions of cream cheese and sour cream.
- Replace sugary, high-fat snacks with fruit.
- Limit your intake of non-diet sodas since a 12-ounce serving has 150 calories and 10 to 12 teaspoons of sugar.
- Drink 100% fruit juice instead of fruit drink.
- For the chocoholic, buy a single serving size or miniature bag of candy. Eat 1 or 2 small pieces a day or share with friends and coworkers.
- Make gelatin more nutritious by adding fruit.

**The Pyramid at a Glance.** Use the Food Pyramid as your tool to make sensible food choices. The Pyramid can help you identify the strengths and weaknesses of your current eating habits. If you consume the recommended servings for each food group daily and eat lower-fat, lower-sugar foods, you will likely get enough protein, vitamins, minerals, and fiber without excessive amounts of calories, fat, saturated fat, and cholesterol. There are also other Food Pyramids, such as the Asian Pyramid, Latin American Pyramid, and the Mediterranean Diet Pyramid. To review a specific Food Pyramid, go to the website at <http://www.usda.gov/cnpp/pyramid.htm>.

## **OBESITY: A WEIGHTY ISSUE**

Despite the fact that more than \$30 billion is spent on weight loss services and products every year, the CDC reports that approximately 55% of Americans are either overweight or obese. Obesity, now a national epidemic, is linked to the major disease killers in the United States—cardiovascular disease, cancer, and diabetes. Overweight and physical inactivity account for more than 300,000 premature deaths annually, second only to tobacco-related deaths.<sup>7</sup> The following sections show you how to determine a healthy weight and successfully manage your weight through the years.

## **WHAT IS YOUR HEALTHY WEIGHT?**

Carrying around excess weight is harmful to your health. But how much is too much? Medical experts agree that your risk for weight-related health problems depends not only on your weight, but also on the amount of body fat you have and where you store it. Healthy weight is a *weight range* that correlates with a less than average risk for weight-related health conditions like heart disease, high blood pressure, and diabetes. A healthy weight may or may not affect appearance. The number on the bathroom scale is not an accurate assessment of where body fat is stored or how much fat a person carries. Use the following guidelines to help you determine your healthy weight range.



**Body Mass Index.** This is a measure used to compare your weight to your height and to assess your risk for weight-related health conditions. For most individuals, a higher Body Mass Index (BMI) correlates with above-average total body fat. The exceptions are athletes or body builders, who may weigh more than that established by weight standards and have a high BMI, but a normal or less-than-normal body fat level. A BMI of less than 25 is an optimal goal for most people, while a BMI of 25 or greater is considered overweight and a BMI over 30 is obese. Calculate your BMI according to the formula in the box below.

$$\text{BMI} = \frac{\text{Your weight (pounds)} \times 704.5}{\text{Your height (in.)} \times \text{your height (in.)}}$$

Expressed in words, your BMI equals your body weight in pounds times 704.5, divided by your height (in inches) squared.

**Waist Size.** Research shows that your waist circumference is linked to health-related medical problems. The larger your waist size, the greater your risk of high blood pressure, diabetes, heart attacks, and strokes. Prominent health organizations, for example, the National Heart, Lung, and Blood Institute, recommend that a man’s waist be less than 40 inches and a woman’s waist less than 35 inches. How to determine waist size is described in the box below.

To measure your waist size, use a flexible tape measure and measure your waist at the level of your belly button. Relax your stomach muscles and exhale. For accuracy, have someone else measure for you.

**Body Fat.** There are several methods to measure body fat, expressed as percent body fat. Likewise, there are several standards for acceptable body fat percentages. For example, all

Criterion	Gender	Healthy Range	Overweight Range
BMI	Both	19-24.9	≥25
Percent Body Fat	Women	15-25	>25
	Men	10-20	>20
Waist Size	Women	Varies	>35 inches (increased health risk when coupled with a BMI ≥25)
	Men	Varies	>40 inches (increased health risk when coupled with a BMI ≥25)

**Table 8.**

branches of the military set their own acceptable measurement methods and percentages of body fat. According to the Institute of Medicine (IOM), overweight is defined as having an excess of body weight, while obesity refers to an excess of body fat. The IOM definition classifies men with more than 25% body fat and women with more than 30% body fat as obese.

Use the criteria above cautiously since different methods for measuring body fat may yield dissimilar results. Depending upon the method, some individuals may be defined as obese when, in fact, they are not when measured by a different method. Accurate methods for measuring body fat include dual energy x-ray absorptiometry (DEXA) and underwater weighing.

Do not use a single guideline to determine your optimum weight. Some people who weigh more than that set in height-weight standards and have a high BMI may not be at increased risk for weight-related health problems if their waist sizes and body fats are at or below recommended levels. Table 8 above sets forth your risk for weight-related health problems based on the guidelines above.

## **WEIGHT GAIN AND AGING**

Getting older does not have to mean weight gain. In fact, many studies have shown that aging does not cause weight gain, but several other factors contribute to weight gain over the years, such as metabolic rate, activity, and eating habits.

**Decreased Metabolic Rate.** The daily number of calories your body requires daily decreases about 2% every decade past the age of 25.<sup>8</sup> If a 25-year-old needs 2,500 calories a day, that same person needs only 2,400 calories at age 45. This slight 100-calorie difference is equivalent to one slice of bread, but if the 45-year-old continues to eat 2,500 calories a day for one year, he or she could gain ten pounds assuming there is no difference in activity. Weight control problems arise when adults continue to eat the same quantities of foods as they age even though metabolism and activity levels may be less than when they were younger.

**Decreased Muscle Mass.** Another consequence of aging is the loss of muscle mass. In individuals who do not exercise, muscle mass may decrease by as much as 40% by the age of 60. Muscle mass is linked to metabolic rate because muscle burns more calories than fat. The more muscle a person loses due to aging and activity reduction, the lower the metabolic rate. To minimize muscle loss, you must participate in some form of regular physical activity. Strength training, in particular, can significantly slow the amount and rate of muscle degeneration. If you do not use muscle, you will lose it.

**Activity Level.** Experts agree that the number one strategy for weight control is physical activity. And it makes sense—when you are active you burn more calories. The type of exercise, the duration, and the intensity determine exactly how many calories you expend. An additional benefit is that exercise tones and builds muscles, which in turn increases metabolic rate. This means that regular exercise increases your daily caloric requirements. The relationship between weight status and activity level is such that overweight and obese

people are often caught in a vicious circle. Excessive weight, by making movement of the body arduous and painful, encourages a sedentary life-style and discourages physical activity. Reduced physical activity in turn promotes still greater weight gain.

Formal exercise does not appeal to many people, and most attempts are abandoned after a few short weeks. The good news is that people who include routine physical activity as part of their everyday life can be just as successful at weight control as those who participate in a formal exercise program. Parking your car at the far end of the parking lot, taking the stairs instead of the elevator, taking a 10-minute walk for stress release, or playing games with your children are ways to incorporate physical activity into your life. Expending an extra 100 calories a day through such activity can lead to a 10-pound weight loss over the course of one year.

**Gender.** Adult males have 10% to 20% more muscle than a female of the same body weight and age, which is why a man's caloric requirements are higher than a woman's. This is also why it is usually easier for a male to lose more weight than a female when following a diet with equal calories.

**Eating Habits.** Many people, especially those who work in high-stress, challenging positions, may forget to eat or not take time to eat. The following scenarios may be familiar—you get through your day by nibbling on a few pretzels, washing down a candy bar with a caffeine-loaded soda, or devouring a lunch of leafy greens. Toward the end of the day, you are absolutely famished. At this point, you could eat everything in the kitchen, and unfortunately you attempt to do just that, although you may not realize it.

Repeated overeating at night to make up for calories you did not eat during the day can cause weight gain. To combat nighttime overeating, redistribute your calorie intake so as to consume more during the day when your body and brain rely on calories for peak performance. Eating during the day may reduce the hunger you experience after work, and if you listen to your internal hunger cues, you may not eat as much food at night.

**Overweight Genes.** Studies show that 80% of children born to two obese parents become obese. Only 14% of children born to normal-weight parents become obese. However, genetics accounts for only about one-third of a person's weight. Thus, factors that you can control, like eating habits and physical activity, have a more significant impact on your weight.

## **CALORIE BASICS**

To estimate your total caloric requirement for the day, you must first determine your basic calorie needs, or your basal metabolic rate. This is the number of calories your body needs at complete rest to support basic functions such as breathing and maintaining heart rate and body temperature. Use the following three instructions to calculate your caloric requirements.

1. **Calculate your basic daily calorie requirements.** Multiply your weight by 10 if you are female or 11 if you are male. If you are overweight, use your healthy or goal weight.

$$\frac{\text{(weight)}}{\text{(10 or 11)}} \times \text{(10 or 11)} = \text{(basic daily calorie requirements)}$$

2. **Determine your activity factor.** Multiply your basic daily calorie requirement by an activity factor to account for the additional calories you expend during the day. Find the activity factor in Table 9 that best describes your usual activity level. Individuals of small body size or with little muscle mass should use the lower numbers when a range is given.

3. **Calculate your actual daily calorie requirements.**

$$\text{(basic daily calorie requirements)} \times \text{(activity factor)} = \text{(actual daily calorie requirement for weight maintenance)}$$

Level of Usual Activity	Activity Factor
Exceptionally Active: Heavy manual labor, recruit training, special operations training, in addition to training as competitive athlete	2.1-2.4
Very Active: Typical workday includes several hours of physical labor, such as light industry and construction-type jobs. Competitive athlete, such as triathlete, marathon runner, body builder.	1.8-1.9
Moderately Active: Sedentary job plus substantial weekend recreation or 1 hour of moderate physical activity on most days or moderate to vigorous exercise three to five times a week. On your feet most of the workday, light lifting only, and no structured exercise.	1.6-1.7
Slightly Active: Sedentary for most of the day and do light activity, such as walking, for no more than 2 hours daily.	1.4-1.5
Sedentary: Describes most Americans. Sit, drive, lie down, or stand in one place for most of the day and do not participate in any type of exercise.	1.3
Very Sedentary: Movement restricted, such as sick at home but not confined to bed.	1.2

**Table 9.**

The preferred method for losing weight is through a combination of eating fewer calories and burning more calories, thus producing a deficit of 250-500 calories daily compared to your

normal weight-sustaining daily calorie intake. An important point to remember is that you will lose weight when you consume fewer calories than what your body requires. There are no

Weight Maintenance: $\text{Calories consumed} = \text{Calories expended}$
Weight Loss: $\text{Calories consumed} < \text{Calories expended}$
Weight Gain: $\text{Calories consumed} > \text{Calories expended}$

magical pills, potions, or foods to jump start your metabolism and melt fat from your body. The equations for weight control are remorselessly simple and uncompromising:

One pound of body weight has the equivalent of 3,500 calories. Thus, in theory, eating 500 fewer calories every day results in a one pound weight loss every 7 days, which is an acceptable goal for most people. Minimum calorie intake levels for weight loss are 1,500 calories a day for men and 1,200 calories a day for women. More severe caloric restriction leads to unsafe, rapid weight loss, a weakened immune system unable to fight off viruses, excessive fatigue, lack of motivation, and a drop in physical and mental performance. Moreover, weight maintenance is not as easy or as effective with quick weight loss. Cutting back 200 calories a day for a year can result in an almost 21-pound weight loss. Table 10 below shows acceptable weight and body fat loss rates by military service:

Military Service	Weight Loss	% Body Fat Decrease
Air Force	5 pounds/month	1%/month
Army	3-8 pounds/month	Undefined
Navy/Marines	1-2 pounds/week	1% every 2 weeks

**Table 10. Acceptable Weight Loss as Defined by Military Service Regulations**

## SENSIBLE EATING TO MANAGE YOUR CALORIES

There are many reasons why people eat the way they do. Lifestyle, job stress, eating habits, emotional situations, genetic factors, and family relationships are just a few of the many factors that affect eating and, ultimately, weight. *Here are several eating tips to help you manage your weight sensibly:*

- Do not super-size your meals. It may be a bargain to buy the super-size meal at a fast food restaurant, but it is not worth the extra calories. Super-sizing a meal can add

300-500 calories to an already high-calorie, high-fat meal. Save yourself the calories. If you eat regular-size meals 4 times a week in lieu of super-size meals, you could lose up to 30 pounds in a year.

- Use smaller plates. We tend to fill a plate or bowl regardless of the size. By using smaller plates, your portions will more likely resemble the Food Pyramid serving size.
- Eat slowly. From the time you start eating, it takes your brain about 20 minutes to decide that your stomach is full, regardless of the quantity of food consumed. Put your fork down between bites and thoroughly chew your food. If you finish your first serving in under 20 minutes, drink a glass of water and wait a few minutes. You will likely feel less hungry and therefore less tempted to have second helpings.
- Eat your meals and snacks from plates. How many times have you sat down at your desk with a bag of chips, only to realize 30 minutes later that you consumed half the bag? To prevent unconscious overeating, open the container of food, place a serving or two on a plate, and put the container away.
- Switch to lower-fat versions of food when possible. Fat has twice as many calories as protein or carbohydrates, so reducing fat content can significantly reduce calories. It is not necessary to choose fat-free versions of all foods since fat is essential for life and provides flavor and enjoyment to eating.
- Read the Nutrition Facts label. Keying in on a few details may help you make better food choices. Look at the serving size. How many servings are in the container? Many breakfast muffins, even the low-fat versions, contain at least 2 servings in one muffin. Pay attention to fat grams and calories from fat. If a food contains over half of its calories from fat, you may want to look for another brand or a low-fat version that contains less fat.
- Fat-free does not mean calorie-free. When buying low-fat or fat-free foods, do not eat them in endless quantities since they do contain calories. Consume only the amount identified as one serving on the Nutrition Facts label, and remember that only eating fewer calories than you need, not fewer fat grams, will result in weight loss.
- Limit your intake of calorie-containing beverages. Studies have shown that people who drink caloric beverages may over-consume calories because calories from beverages are not as filling as calories from food. Eliminating two 12-ounce non-diet sodas or beers every day can take off 30 pounds in a year.
- Fill up on fiber. High-fiber foods like fruits, vegetables, and whole grains are filling because they occupy more space in your stomach, leaving less room for high-calorie foods. Fruits and vegetables contain considerably fewer calories than other foods. For example, to get the same caloric content of one doughnut, you can eat an apple, a

handful of baby carrots, and drink a medium glass of juice. Replace a mid-morning pastry with a serving of fruit each day and lose 10 pounds in a year.

- Prevent yourself from becoming either famished or stuffed. Eating when famished may lead to overeating. How many times have you ferociously inhaled a large quantity of food after hours of eating very little? More than likely, you gobbled down your food and never gave your brain 20 minutes to register that you were full. Maintaining your hunger levels somewhere in between the two extremes can help reduce overeating.
- Set realistic goals. Aim for a 1 to 2 pound weight loss per week. If you want to lose a lot of weight, divide the weight loss into smaller, attainable goals.
- Lastly, but most importantly, do not deny yourself food. Enjoy all of your favorite foods in moderation. Ignoring your cravings may end in binges that pack on extra pounds. Satisfy a craving before it becomes all-consuming by allowing yourself to eat a small portion. Eating a handful of chips with lunch is better than devouring a whole bag for a late night snack.

## **THE DIET CRAZE: FACTS, FADS, AND WARNINGS**

At any one time, approximately two-thirds of Americans are struggling with their weight. A 1995-1997 survey of active duty Army personnel indicated that approximately 60% of women and 37% of men reported trying to lose weight in the preceding 12 months.<sup>9</sup> Search for “diet” on the Internet, and you are bombarded with thousands of web sites proclaiming the success of miracle diets. Americans gobble up these diets almost as much as they do burgers and fries. Yet, research shows that 95% of people who lose weight will regain all of it, if not more, within 5 years. You can improve your weight control success by losing weight slowly (1-2 pounds/week), consuming fewer calories, expending more calories through activity/exercise, and incorporating permanent life-style changes in your eating and activity habits.

**Diet Facts.** For most people, diets are not successful over the long term. Popular diets often require the elimination of some foods or adherence to specific menu plans without substitutions. Most people can adhere to strict limitations for a short time, but not for the rest of their lives. How you eat to lose weight is very similar to how you eat to maintain weight. The difference between weight loss and maintenance is generally a few hundred calories, the equivalent of one small sandwich daily.

Do not use the word “diet” to describe how you lose weight. This word invokes dreadful thoughts of starvation, lettuce salads, and deprivation. For most people, diets are not necessary or practical for weight management. Think about your own eating habits. Do you snack when you are not hungry? Do you try to make it through the day with minimal food intake and then overeat at night? Does your physical activity consist of getting up and down from your desk to go to meetings? Do fast food restaurants seem like your home away from

home? Making a few simple changes in your eating habits can result in significant weight loss over time. For example:

- Substituting a side salad and low-fat dressing for french fries saves you 220 calories per meal, resulting in a 10-pound loss in a year, assuming 3 such substitutions a week.
- Replacing one alcoholic beverage a day with water saves you 100 to 200 calories, or 15 pounds a year.
- Eating a medium-size bowl of whole-grain cereal and low-fat milk for breakfast instead of a fast food breakfast sandwich saves you 150 to 250 calories a day and produces a loss of 15 pounds a year.

Diets often fail to teach you how to make appropriate food choices on your own. Diets use a cookbook approach to weight loss—one recipe fits all. The error in this approach is that people respond to weight loss differently and have specific food preferences. For successful weight loss and maintenance, choose healthy foods that you like and tailor your eating habits to your lifestyle—create a program that you can live with for the rest of your life.

**Diet Fads.** If you are a “diet connoisseur,” you may have realized that many diets are based on similar assumptions, but are disguised under different names. Diets seem to parallel fashion trends—particular diet crazes become trendy. Popular high-protein, low-carbohydrate diets of the 1970s and 1990s identified carbohydrates, not calories, as the culprit of weight gain. These diets did not solve our weight problems 30 years ago, nor do they today. The following sections take a look at the facts and fiction behind popular diets.

*Food Specific Diets.* These diets claim that some foods possess special qualities to aid in weight loss. Here is the fact: no single food is magical when it comes to weight loss. Grapefruit does not burn fat, and cabbage does not rev up your metabolic rate. How do these diets work? Eating a very limited selection of foods often results in boredom. You get tired of eating the same foods day after day and eventually you eat fewer calories than you did before, which results in weight loss. These diets do not promote healthy eating habits. Moreover, following them over the long term would be very difficult. Be realistic—do you really want to eat cabbage soup every day for the rest of your life?

*High-Protein, Low-Carbohydrate Diets.* The idea behind these diets is that carbohydrates cause weight gain and obesity. The diet’s advocates claim that carbohydrates increase insulin levels in the blood, causing carbohydrate calories to be stored as fat. The truth is that insulin is released into the bloodstream when carbohydrates are consumed. However, carbohydrates are stored as fat only when one eats more calories than needed, regardless of whether it is fat, protein, or carbohydrate calories.

Some people who have large waists release more insulin when they consume simple sugars like sodas, candy, cakes, and cookies. The insulin quickly removes the excess sugar from the bloodstream, which lowers blood sugar. Eating sugary foods does not necessarily



result in more fat storage, but it does tend to increase the feeling of hunger again, which can lead to overeating. Eating carbohydrates does not cause problems with insulin. Being overweight and inactive causes insulin problems.

People may lose weight on these diets because the prescribed menus provide only 850 to 2,000 calories a day, significantly fewer than the average American consumes on a daily basis. Initial weight loss is primarily water as the body depletes its carbohydrate stores (carbohydrates are stored in the body with lots of water). Subsequent weight loss occurs as the body "eats" its muscle tissue for energy since daily caloric intake is not enough to meet the body's requirements. Eventually the body may burn fat stores; however, body fat percentage may actually increase as a result of eating more fat from high-fat protein sources and the body's ability to hold on to fat stores as it consumes muscle and other major organs for energy.

When too few carbohydrates are consumed, the liver converts body fat and dietary fat into energy. This potentially harmful condition is called ketosis. Ketones are by-products of ketosis, and if they are not excreted in the urine, they can reach toxic levels in the bloodstream. Your liver and kidneys work harder than usual to excrete them. To reduce the risk of ketone toxicity, very low carbohydrate diets (5 to 25 grams of carbohydrates per day) should not be consumed for more than 14 consecutive days. Side effects of ketosis include nausea, weakness, dehydration, fatigue, insomnia, "fruity" breath, and a diminished appetite. The latter, considered to be a favorable side effect, is the most common. Consuming approximately 100 grams of carbohydrates per day can prevent ketosis.

Another risk to eating high-protein diets is the implication for heart disease. Most people experience a reduction in blood cholesterol levels during weight loss, regardless of the type of diet. However, high-protein diets can be much higher in fat than one typically consumes. High-fat diets can increase the risk for heart attacks, stroke, and some types of cancers. Additionally, high-protein, low-carbohydrate diets may be low in potassium, vitamins A and C, folic acid, carotenoids, and fiber—all of which help to prevent certain cancers and heart disease. Thus these diets should be used with caution. Persons with known kidney disease or a family history of kidney problems should be especially cautious since these diets can potentially aggravate or cause kidney complications.

Do high-protein, low-carbohydrate diets promote healthy life-long eating habits? Can you live without cookies, pancakes, or pasta for the rest of your life? Will you end your weight problem forever if you deny yourself carbohydrates? The answer is probably no to all three questions.

*Liquid Diets.* There are two types of liquid diets: medically supervised diets permitting very few calories and over-the-counter liquid meal replacements. Liquid meal replacements are sold as beverages in almost every grocery store, convenience market, and pharmacy from coast to coast. The manufacturers of these products claim that drinking two beverages during the day and eating a "sensible" dinner causes weight loss. If the only food you consume all day is two 250-calorie liquid meals, how "sensible" is your dinner going to be? You will probably be famished at the end of the day.

The human appetite is stimulated and satisfied by smell, taste, texture, and chewing. Ask yourself if you are really going to be satisfied with “drinking” your calories. Drinking them over the long term will likely not produce the desired weight loss. Data published by one of the meal replacement companies showed that after more than 2 years on the program, women lost a total of 13 pounds and men lost 14 pounds.<sup>10</sup> This result is the equivalent of a half-pound weight loss per month. Only 51% of those who enrolled in the program stayed for its entirety, despite receiving \$25 a week to stay on the plan.

If you like these beverages, use them as emergency meals when you are hungry and there is no time for anything else, or as a convenient “energy boost” during the day. For weight control, think realistically—how can you change your eating habits permanently?

**Diet Warnings.** The news media bombard us with nutrition stories daily. According to the American Dietetic Association’s “Nutrition and You: Trends 2000” survey, approximately 47% of Americans regard television and magazines as their major sources of nutrition information. Forty-three percent like to hear about new research studies, but 37% believe that the news tells them only what they should *not* eat. To separate fact from fiction, here is a list of questionable diet recommendations to be alert for:

- Programs or diets that promise a quick fix. A quick fix often turns out to be a temporary fix. You did not gain weight overnight and you surely are not going to lose it overnight.
- Claims that sound too good to be true. Flashy statements like “eat these foods to lose weight” and “this pill magically melts fat and increases your energy” are extremely enticing and make weight loss sound easy. The truth is that weight loss is not easy. It takes discipline, common sense, and strong motivation.
- Diets that eliminate specific foods or food groups. Remember that your body needs over 40 different nutrients to function at its best. Limiting some foods for a length of time can lead to nutrient deficiencies, which affect both your performance and health.
- Diets that include “good food” and “bad food” lists. All foods can fit into a healthy eating plan. The key is to eat high-calorie, nutrient-deficient foods less often and in small quantities. Be sensible—reward yourself with a candy bar or a doughnut once or twice a week instead of every day and lose 4 pounds in 6 months.
- Diets or gimmicks that are not approved by reputable organizations such as the American Dietetic Association, the American Heart Association, or the American Medical Association. Professional organizations support many health and weight measures that are backed by years of well-documented and published research. Many diet products are not supported by legitimate research.

- Diets or programs that ignore differences among individuals. A successful weight control program makes allowances for individual needs, wants, and desires, and no one else's. A personal plan may promote a lifelong behavior change.
- Diets and products that dismiss the importance of exercise in either weight loss or maintenance.
- Diet claims based on research published without peer review. Articles published in a peer-review journal are scrutinized and approved by several licensed professionals or scientists prior to publication, and only legitimate research is printed in peer-review journals. The authors of several best-seller diet books do not publish their research in peer-review journals.
- Diet gimmicks based on a single research article. Reported research findings from a "new study" can create unnecessary alarm and confusion. One study does not change everything that we have known to be true for several years. Studies conducted by other researchers with the same results are more valid than a single study.

## EATING FOR LONGEVITY AND HEALTH

Eating-for-health strategies are similar to those based on eating for performance. At times, it may be difficult to see the big picture within the do-more-with-less environment in which you may live. You survive each day, somehow keeping pace with the clock and managing to eat healthfully sometimes. You may ask yourself, "Is it really worth it?" The answer is yes. Look beyond today. How you eat for performance today fuels your health for tomorrow. The following sections shed light on achieving lifelong health and ultimately a rewarding quality of life.

<b>Recommended Dietary Fiber Consumption</b>
<i>Adults:</i> 25 – 35 grams/day or 10 – 13 grams per 1000 calories consumed
<i>Children:</i> Age + 5, e.g. a 10-year old should eat 15 grams/day (10 + 5)
<i>Source:</i> National Cancer Institute

**Table 11.**

**Fiber: Your Link to Disease Prevention.** Dietary fiber, a type of complex carbohydrate, is a key component of a healthy diet. Whole-grain products and starchy beans,

fruits, and vegetables supply not only fiber, but also essential vitamins, minerals, and phytochemicals that reduce your risk of some chronic diseases. Although numerous research studies have documented the many benefits of eating adequate fiber, most Americans do not consume enough. See Table 11 above for the amounts recommended.

What is fiber? Fiber is the non-digestive part of plant foods. Your body cannot break down fiber, and it passes through your intestines unabsorbed. Inside the stomach, some types of fiber (see next section) act like a sponge, absorbing some of the sugar, fat, and cholesterol that are present. Therefore, eating a meal with substantial fiber can significantly reduce or slow the amount of sugar, fat, and cholesterol that enter into your bloodstream. Limiting the amount of fat and cholesterol in the bloodstream helps to reduce blood cholesterol levels and heart disease risk. Slowing the absorption of sugar helps control blood sugar levels in diabetics.

Fiber is filling, and people who eat more fiber generally weigh less than those who do not consume as much. This may be because fiber takes up space in your stomach, causing a feeling of fullness. As fiber intake increases, caloric intake may decrease because you are not as hungry for other foods, like desserts, sweets, and high-calorie foods.

Benefits of fiber can be summed up as follows:

- Promotes regular bowel movements.
- Can ease symptoms of chronic constipation, hemorrhoids, and diverticular disease.
- Helps normalize blood sugar levels.
- Helps with weight loss and weight management.
- May help prevent heart disease and certain cancers.

There are two kinds of dietary fiber—soluble and insoluble.

- *Soluble fiber* absorbs water and slightly expands to create a gel-like substance. A similar event occurs when you add liquid to oatmeal (a soluble fiber); it swells and thickens as it cools. Soluble fiber helps reduce blood cholesterol levels and control blood sugar levels. Foods such as oats and oat bran, barley, brown rice, starchy beans, and many vegetables and fruits contain soluble fiber.
- *Insoluble fiber* does not absorb water and is primarily responsible for moving waste products through your intestinal tract. Whole-grain breads and cereals, wheat and corn bran, many vegetables, and the skins of fruits and vegetables contain insoluble fiber that promotes intestinal health, to include the prevention of colon and colorectal cancers, constipation, and hemorrhoids.

Depending upon your reasons for increasing dietary fiber, you may eat one type of fiber more often. However, an ideal goal for most people is to eat the amount of fiber recommended by the National Cancer Institute, regardless of whether it is soluble or insoluble.

You may think you are eating enough fiber, when in fact you are not. If you increase fiber in your diet, do so slowly to give your body time to adjust. A sudden increase in fiber consumption can cause uncomfortable bloating, nausea, and cramps. Also, drink lots of fluids, preferably water, to help fiber move easily through your intestinal tract. Read the Nutrition Facts label for the fiber content. Many labels do not distinguish between soluble and insoluble fiber; many list the total fiber content. Upon reviewing some labels, you may be surprised to realize that the fiber content is not as high as you expected.

- *How to Spot Whole Grain Products.* The term “whole-wheat” or “whole-grain” must be in the ingredient list, preferably as the first or second ingredient. Brown bread made from “wheat flour” or “unbleached wheat flour” *is not* whole-grain bread. Cereals and crackers labeled as “multi-grain” may contain very minimal fiber. Examples of whole-grains: whole wheat flour, brown rice, oatmeal, oats, wheat germ, barley, millet, and quinoa.
- *Products That Are Not Whole Grain.* Cream of wheat, cream of rice, pasta, couscous, and products made from “wheat flour” or “unbleached wheat flour” do not contain whole grains. Wheat flour has the same nutritional value as white flour; it is simply not bleached white.
- *Good Source of Fiber:* A food with at least 2.5 grams of fiber per serving.

The majority of studies validating the many benefits of fiber are based on the use of real food instead of fiber supplements. Therefore, fiber alone may not be responsible for good health. Possibly, the combination of fiber and other powerful nutrients like phytochemicals, vitamins, and minerals is responsible for fiber’s potent favorable impact on disease prevention. *Tips for getting more fiber are:*

- Choose brown rice over white rice.
- Buy cereals that have 2.5 or more grams of fiber per serving.
- Mix a high-fiber cereal (10 to 13 grams of fiber/serving) with lower-fiber cereals.
- Make sandwiches with whole-grain breads, like whole wheat bread.
- Enjoy whole-grain crackers, like Triscuits, with cheese or peanut butter.
- Eat starchy beans like kidney, pinto, or navy beans. Add to salads, toss with vegetables, or eat them plain.
- Eat fruit as snacks or mix with yogurt, cereal, or salads.

- Enjoy vegetables with meals or snacks.
- Mix wheat germ with yogurt.

**The Truth About Dietary Fat.** You need to eat some fat for health, but eating too much fat, especially saturated fat, increases your risk of heart disease, including heart attack and stroke. The American Heart Association recommends that 30% or less of your calories come from fat, broken down among the three fat groups as follows: saturated, 8-10%; monounsaturated, 10-15%; and polyunsaturated, less than 10%. The following sections review the dietary implications of fat and its different types.

*Fat.* Most experts agree that a diet containing 20% to 30% fat is a reasonable goal for nearly everyone. Although consuming a diet that contains less than 10% fat has been proven

<b>Calorie Level</b>	<b>Daily Fat Gram Allowance</b>
1,200	27-40
1,500	33-50
1,800	40-60
2,000	44-65
2,500	56-83
3,000	67-100
3,500	78-117

**Table 12.**

<b><u>TYPICAL MEALS</u></b>	<b><u>MODIFIED MEALS</u></b>
Ham, egg, & cheese bagel 550 cal, 25 grams of fat	1 cup bran flakes with low-fat milk 1 banana 1 cup juice 360 cal, 5 grams of fat
Bacon & cheese grilled chicken sandwich Large order of french fries Large non-diet soft drink 1,610 cal, 67 grams of fat	Grilled chicken sandwich Small order of french fries Water 600 cal, 30 grams of fat
12-oz sirloin steak Caesar salad Baked potato with 2 tbsp butter 1,100 cal, 58 grams of fat	12-oz sirloin steak Salad with fat-free dressing Baked potato with 1 tbsp butter 840 cal, 21 grams of fat
<b>Daily Total:</b> 3,260 calories 150 grams of fat (41% fat)	<b>Daily Total:</b> 1,800 calories 56 grams of fat (28% fat)

**Table 13.**

to reverse heart disease and the damage caused by high cholesterol levels, it is probably not a

realistic goal for most people. Eating less than 10% of your calories from fat is simply too restrictive, and therefore would be very difficult to maintain long-term.

Your fat intake allowance depends on your daily caloric intake. Table 12 above shows what your daily fat gram allowance is for a diet of various calorie levels but all containing 20% to 30% fat.

Fat intake can add up quickly during the day, especially if you dine out frequently. Restaurant food can be much higher in fat than you typically consume at home. Table 13 above shows how slight modifications can significantly change total fat intake for the day.

Read the Nutrition Facts label for fat content or ask for nutrition information at restaurants. Even seemingly harmless beverages like popular cappuccinos and frozen coffee drinks can contain 22 to 44 grams of fat depending on the size and contents.

*Saturated Fat.* Not all fat is created equal. It is important to limit total fat, but it is *very* important to limit saturated fat intake. Saturated fat is generally solid at room temperature. It is the dense, opaque fat that floats on the top of broth. Saturated fat is the marbling seen in meats, but it is also hidden between the muscle fibers of meat and not always visible. A diet high in saturated fat can clog arteries and increase blood cholesterol levels even more than dietary cholesterol intake. Eating excessive amounts of saturated fat can ultimately cause heart attacks and strokes.

*Unsaturated Fat.* Unsaturated fats, such as monounsaturated and polyunsaturated, help decrease blood cholesterol levels, therefore reducing your risk for heart attack and stroke. Unfortunately, many Americans consume too much saturated fat and not enough unsaturated, particularly monounsaturated. In comparison to saturated fats, unsaturated fats are soft or liquid at room temperature.

*Trans Fatty Acids.* Research has shown that these fats can increase cholesterol levels just as much as saturated fat does. Trans fatty acids are found naturally in small amounts in meat and milk, and they are created artificially when unsaturated, liquid fat is chemically altered to create a fat that is more solid and shelf-stable. This process is called hydrogenation. Margarine and shortening are examples of hydrogenated fats since they were created from the chemical transformation of liquid oils into solid fats. Try to avoid products where “partially hydrogenated oil” or “hydrogenated oil” is listed in the ingredient list (manufacturers are not required to print the amount of trans fatty acids on the label); be cautious of margarines, prepared foods, cookies, and crackers, many of which contain trans fat. In lieu of regular margarines, buy Promise, Smart Beat, or Fleischmann’s trans-free margarines; begin looking for stated grams of trans fatty acids (which may be required in the future). Try Benecol and Take Control products (margarine-like spread and salad dressing) which are made of plant sterol esters, not trans fats, and claim to “promote healthy cholesterol levels.”

The food industry is experimenting with low-trans and trans-free alternatives to use in baking and cooking. Until they become available, you should think twice about ordering

popular restaurant appetizers. Consider: Batter-dipped fried onion has 2,100 calories and 163 grams of fat, 81 of which are saturated and 18 trans fat. Cheese fries with ranch dressing have 3,000 calories and 217 total fat grams, 81 grams of which are artery-clogging saturated

Type of Fat	Food	Role
<b>Saturated Fat</b>	Butter, lard, dairy products (except fat-free), meat, poultry, tropical oils: palm, palm kernel, coconut oils	Increases blood cholesterol levels and low-density lipoprotein (LDL) levels (bad cholesterol)
<b>Polyunsaturated Fat</b>	Corn, sesame, cottonseed, soybean, sunflower, and safflower oils	Decreases LDL levels
	Fish oils (omega-3 fatty acids) found in salmon, mackerel, herring, tuna	Helps prevent blood clots
<b>Monounsaturated Fat</b>	Canola, olive, and peanut oils	Decreases LDL levels

**Table 14.**

fat and 11 grams of trans fat. That is the fat equivalent of eating a 16-ounce prime rib, a 9-ounce country fried steak, and a super-size order of fries topped off with a fudge brownie sundae!

The differences between types of fat can be very confusing even to the most knowledgeable of consumers. Table 14 above provides a quick look at which foods contain which types of fat and their corresponding roles:

**Cholesterol Facts.** Although cholesterol is a fat-like substance, it is not a fat. The term cholesterol refers to two different types: serum cholesterol circulating in the bloodstream, and dietary cholesterol found in food. In the body, cholesterol functions as a constituent of all body cells and of some hormones. It also helps with fat digestion and, along with sunlight, helps produce vitamin D.

While many factors affect blood cholesterol levels, the cholesterol that circulates in your body comes from two sources: your liver and the foods you ingest. Your liver produces enough cholesterol to meet your needs. When your liver produces too much cholesterol, your blood cholesterol level may rise, increasing your risk for heart disease. Dietary cholesterol is found in foods and beverages of animal origin, such as eggs, meats, poultry, fish, and dairy products.



Eating excessive amounts of dietary cholesterol is one factor that elevates blood cholesterol levels in some people. However, dietary cholesterol does not automatically become blood cholesterol. Your total fat intake, especially saturated fat, has a more significant effect on blood cholesterol levels than dietary cholesterol alone.

To reduce your risk of heart disease, the American Heart Association recommends that Americans consume no more than 300 milligrams of dietary cholesterol a day. Often, foods high in cholesterol are also high in saturated fat. Therefore, reducing your saturated fat intake may cause a simultaneous decrease in cholesterol intake.

Foods from plant sources do not contain cholesterol, but some plant-derived foods may supply fat, which is mostly heart-healthy unsaturated fat. Although the fat content can be relatively high for the small portion size, the foods shown below and other similar foods high in unsaturated fat can be part of a sensible, healthy diet when consumed in moderation.

- Peanut butter (2 tbsp): 0 mg cholesterol, 16 g of fat, of which only 3 g are saturated fat
- Walnuts (1/3 cup): 0 mg cholesterol, 20 g fat, 2 g saturated fat
- Olive oil (1 tbsp): 0 mg cholesterol, 14 g fat, 2 g saturated fat

*Here are some additional tips for maintaining or improving heart health:*

- Reduce meat portions to 2-3 ounces per meal for a total of 4 to 7 ounces a day. A 3-ounce portion is about the size of a deck of cards.
- Increase your intake of food that contains minimal fat, such as fruits, vegetables, and whole-grain complex carbohydrates.
- Choose low-fat/fat-free dairy products or limit your intake of whole-fat dairy foods, like cheese and whole milk.
- Enjoy 1 or 2 “meatless” meals per week. Eat dry beans (kidney, navy, pinto beans), tofu, or meatless chili instead of protein-containing food of animal origin.
- When possible, use oils in place of solid fats.
- Use liquid or tub margarine instead of stick margarine. The more solid the margarine, the higher the trans fatty acid content.
- Eat a fish-containing meal at least once a week for a source of heart-healthy fish oils.
- Eat a small handful of nuts 3-4 times a week to increase your intake of unsaturated fat.

**The Secrets of Soy.** In 1999, the Food and Drug Administration (FDA) approved the use of health claims with regard to foods containing soy protein. This step was based on the conclusions of both the FDA and scientific researchers that eating soy protein in combination with a diet low in saturated fat and cholesterol may reduce the risk of heart disease by reducing blood cholesterol levels. To qualify for this claim, a food must contain at least 6.25 grams of soy protein per serving. Scientific studies show that 25 grams of soy protein eaten daily is enough to lower LDL, or “bad” cholesterol, by about 10% in people who have an LDL level above 160.

The isoflavones found naturally in soy protein are largely responsible for the beneficial action of soy products. Isoflavones are phytoestrogens, or weak estrogen-like substances, made by plants. The theory is that they may protect the heart like the estrogens that are naturally produced by premenopausal women or the estrogen pills taken by postmenopausal women. Since research studies are based upon soy protein powders, the benefit of taking isoflavone supplements in isolation is unknown. Soy protein may offer other potential health benefits for cancer, menopause, and osteoporosis. However, more research is needed in these areas before firm conclusions can be drawn.

Following is a list of common soy-containing foods and their average soy protein content as stated on the Nutrition Facts label. For heart health, aim to eat 25 grams of soy protein a day.

- 3 oz water packed tofu: 8.5 grams
- 3 oz silken firm tofu: 6 grams
- 8 oz plain soymilk: 8 grams
- 8 oz vanilla soymilk: 6 grams
- ¼ cup soynuts: 12 grams
- 2 tablespoons soynut butter: 8 grams
- 1/3 cup soy protein powder: 18 grams
- oz soy protein crumbles (1/2 cup): 9 grams
- 1 soy burger: 10 grams
- ½ cup black soybeans: 9 grams
- 1 soy protein bar: 14 grams
- ¼ cup dry textured vegetable protein: 12 grams

**The Confusing World of Dietary Supplements.** In 1998, Americans spent more than \$12 billion on dietary supplements that promised everything from weight loss and more energy to delayed aging and a cure for impotence. With more than half of the American population ingesting some type of supplement, the question is, "Are they safe and effective?"

A dietary supplement is any product intended for ingestion as a supplement to food intake. Such supplements include vitamins, minerals, herbs, botanicals and other plant-derived substances, amino acids, and food concentrates, metabolites, constituents, and extracts. Because many consumers believe that dietary supplements benefit health and want the right to choose which supplements to take, Congress in 1994 passed the Dietary Supplement Health and Education Act (DSHEA). Under DSHEA, dietary supplements are recognized as separate from drugs and are not required to undergo years of safety testing before being put on the market. This is in direct contrast with the marketing of drugs, which must undergo years of clinical studies to determine their effectiveness, safety, possible interactions with other substances, and appropriate dosages, all subject to subsequent review and approval by the FDA.

Dietary supplement manufacturers, however, need only submit to the FDA information to support their conclusion that the ingredients in their supplements are reasonably safe. Once a dietary supplement becomes available for purchase, the FDA must prove that it is unsafe before it can take action to restrict its use. Such was the case in 1997 when the FDA proposed to limit the amount of ephedra-containing substances in dietary supplements (marketed as ephedra, ma huang, Chinese ephedra, and ephedrin) and warned consumers of the potential hazards associated with its use. There have been over 800 reported adverse reactions and at least 39 deaths associated with ephedra-containing products. Since individual states may restrict or stop the sale of potentially harmful dietary supplements within their jurisdictions, several states restrict or ban the sale of ephedra-containing supplements.

All dietary supplements must have a supplement label that lists the ingredients and provides truthful information to assist consumers in making informed choices. Moreover, the label must contain the following declaration: "This statement has not been evaluated by the Food and Drug Administration. This product is not intended to diagnose, treat, cure, or prevent any disease." The fact is that many manufacturers do not have legitimate scientific evidence to support their claims. In several circumstances, the FDA has instructed manufacturers to modify a claim because there was no existing research to support it.

Since there is not a strict government authority to regulate the dietary supplement industry, take caution when buying dietary supplements. Remember these facts the next time you consider taking a supplement:

- Of more than 20,000 dietary supplements on the market, only 46 have received a safety review by the FDA.
- There are no quality standards to ensure that products do not contain dangerous pesticide residues, chemical contaminants, or heavy metals, like lead or mercury.

- Studies conducted by independent researchers show that some dietary supplements contain none of the active ingredient stated on the label. Other supplements contain the active ingredient, but not in the amount stated on the label and still other supplements cannot be broken down and absorbed in the body.
- Unlike prescription drugs, dietary supplements can be sold without having proven benefits.

Informal polls report that many Americans believe that dietary supplements can help stop cancer and a majority believe they can help treat arthritis and colds. The manufacturers do not need proof! Americans will spend billions of dollars on these products every year, regardless of their actual safety or effectiveness.

If you take dietary supplements, consider these recommendations:

- Read reputable web sites, health newsletters, and medical journals for the most current and accurate information on a specific dietary supplement. See Appendix D for a list of resources.
- Buy supplements manufactured by nationally known companies since they are more likely to conduct research on their products.
- Start with a small dose of the supplement to monitor side effects. Slowly increase to the recommended dose on the label while continuing to monitor for any adverse side effects.
- Use single herbal supplements instead of a combination of herbal products in one supplement. This enables you to determine which herb may cause an adverse reaction.
- Pregnant or breastfeeding women and children should not take dietary supplements unless prescribed by a physician.
- Take herbal supplements and prescription drugs at different times since some herbs may interfere with a drug's action. Additionally, mixing some herbs and drugs may cause severe medical complications or even death.
- Stop taking dietary supplements as least 2 weeks before an elective surgery.
- Tell your health care provider what dietary supplements you are taking.
- Most importantly, report an adverse reaction from a dietary supplement to the FDA's MedWatch system at 1-800-FDA-1088 or file a report at <http://www.fda.gov/medwatch/>.

## EATING FOR PERFORMANCE AND HEALTH: PUTTING IT ALL TOGETHER

This chapter has supplied you with the nutrition facts you need to make sensible food choices. There are no magic pills, potions, or foods to guarantee a healthy life. However, here in summary form are 10 precepts to help you maximize your performance each day and promote life-long health:

- Eat at least 5 servings of fruits and vegetables daily.
- Eat a healthy breakfast and then eat at least two more meals throughout the day, consuming foods from all groups of the Food Pyramid.
- Use the Food Pyramid as a guide to appropriate portion sizes.
- Implement a personal healthy eating plan that is adapted to your lifestyle.
- Stock healthy, non-perishable foods in your office, car, and suitcase.
- Balance your caloric intake with your caloric expenditure.
- Eat a moderate amount of fat (20% to 30% of your calories), but reduce your intake of artery-clogging saturated fat.
- Choose whole-grain complex carbohydrates as often as possible, while limiting your intake of added sugars.
- Eat at least 4 to 7 ounces of low- to moderate-fat protein-rich foods throughout each day.
- Drink a minimum of 64 ounces of fluids a day, limiting caffeine-containing beverages.

The ancients tell us, “Mens sana in corpore sano” (“Cultivate a sound mind in a sound body”). It is hoped that in this chapter you have learned what foods to eat as part of a long-term life program to achieve both a sound mind and body.

### ENDNOTES

1. Nancy Clark, *Sports Nutrition Guidebook*, Champaign, IL: Human Kinetics, 1997.
2. W. D. McArdle et al., *Exercise Physiology*, Baltimore, MD: Williams & Wilkins, 1996.
3. Nancy Clark, *Sports Nutrition Guidebook*, Champaign, IL: Human Kinetics, 1997.

4. L. Harrison et al., *Physical Activity Patterns and Satisfaction with Fitness Facilities among Military Members and their Families*, MFR Technical Report 98-3 (AD Number: A355559), Scranton, PA: The Military Family Institute of Marywood University, 1998.
5. D. S. Michaud et al., "Fluid Intake and the Risk of Bladder Cancer in Men," *New England Journal of Medicine*, Vol. 340, 1999, pp. 1390, 1424.
6. *Nutrition Action Healthletter*, November 1998.
7. D. B. Allison et al., "Annual Deaths Attributable to Obesity in the United States," *Journal of the American Medical Association*, Vol. 282, 1999, pp. 1530-1538.
8. National Research Council, *Recommended Dietary Allowances*, 10th Edition, Washington, DC: National Academy Press, 1989.
9. J. T. Warber et al., *The Army Food and Nutrition Survey, 1995-97*. Technical Report T00-6 (AD Number: A371817), Natick, MA: U.S. Army Research Institute of Environmental Medicine, 1999.
10. J. Kirby, *Dieting for Dummies*, Foster City, CA: IDG Books Worldwide, 1998.

## APPENDIX A. PYRAMID SERVING SIZES

### VISUALIZING FOOD AMOUNTS

- **Golf Ball** = 1 oz meatball or 2 tbsp peanut butter
- **Deck of cards** = 3 oz of cooked meat
- **3 Dominos** = 1 ½ oz cheese
- **Baseball** = 1 cup
- ½ **baseball** = ½ cup
- **Thumb** = 1 oz cheese
- **Tip of thumb** = 1 tsp

### BREAD, CEREAL, RICE, & PASTA GROUP

(low-fat choices have 80–100 calories)

- 1 slice bread
- 1 small roll, biscuit, or muffin
- 5-6 small crackers (saltine size)
- 3-4 large crackers (graham cracker size)
- ½ cup rice, pasta, or cooked cereal
- 1 oz dry cereal (1/2–1 cup depending on type)
- 1 4-inch pancake
- 2 cups hot-air popped popcorn

### VEGETABLE GROUP

(15-40 calories; starchy vegetables have 100 calories)

- ½ cup cooked vegetables
- ½ cup cooked dry beans (if not counted as a meat)
- ½ cup tomato or spaghetti sauce
- 1 cup raw, leafy vegetables
- ¾ cup vegetable juice
- 1 small baked potato
- 1/2 cup cole slaw (contains added fat)

## **FRUIT GROUP**

(60-100 calories)

- ½ cup raw/canned/cooked fruit
- 1 medium whole fruit, such as apple, banana, orange, nectarine
- ¾ cup juice
- ½ grapefruit
- 10-12 grapes
- ¼ cup dried fruit or raisins

## **MILK, YOGURT, AND CHEESE GROUP**

(90 calories or more)

- 1 cup (8 oz) milk or yogurt
- 1 ½ oz natural cheese (cheddar, feta, blue, mozzarella)
- 2 oz processed cheese
- ½ cup ricotta cheese
- 2 cups cottage cheese (to equal calcium in 8 oz milk)



- 1 cup frozen yogurt
- 1 ½ cups ice cream

## **MEAT, POULTRY, FISH, EGGS, DRY BEANS, & NUTS GROUP**

(55-75 calories per oz for lean to medium-fat meat, 100 calories per oz for high-fat meat or 2-3 oz cooked, lean meat without bone)

- ½ of 6 ½ oz can tuna in water (3+ oz)
- 1 medium chicken breast half (3 oz)
- 2 chicken legs (3 oz)
- ¾ cup cooked chopped meat (3 oz)
- piece of meat the size of a deck of cards (3 oz)
- 1 egg (1 oz)
- ½ cup cooked dry beans, if not counted as a vegetable (1 oz)
- 2 tbsp peanut butter (16 grams of fat)
- 1/3 cup nuts (20-25 grams of fat)
- ¼ cup seeds, like pumpkin/sunflower (1 oz contains 5-20 grams of fat)
- 1 oz cheese (if not counted as dairy)

## **PYRAMID TIP**

*Fats.*

- |                          |           |
|--------------------------|-----------|
| ● 1 tsp margarine/butter | 30-35 cal |
| ● 1 tbsp mayonnaise      | 100 cal   |
| ● 1 tbsp salad dressing  | 60-80 cal |
| ● 1 tbsp cream cheese    | 50 cal    |
| ● 1 tbsp sour cream      | 30 cal    |

- tbsp cooking or salad oil 120 cal
- 1 slice bacon 35 cal

*Sweets.*

- 1 tsp sugar/jam/jelly 15 cal
- 1 tsp honey or syrup 20 cal
- 20 fluid oz non-diet soda 250 cal

## APPENDIX B. LACTOSE-CONTAINING FOODS

Product	Serving	Approximate Lactose (grams)
Milk: whole, low-fat, skim, sweet acidophilus, buttermilk	1 cup	10-12
Goat milk	1 cup	9
Lactose-reduced milk	1 cup	2-4
Nonfat dry milk	1/3 cup	12
Half-and-half	½ cup	5
Whipping cream	½ cup	3
Sour cream	½ cup	4
Butter/margarine	1 tsp	Trace
Cottage cheese	½ cup	2-3
Yogurt, low-fat	1 cup	5
Cheese: American, Swiss, blue, cheddar, parmesan, or cream cheese	1 oz	1-2
Ice cream, regular and low-fat	½ cup	6-9
Sherbert, orange	½ cup	2

## APPENDIX C. IRON-CONTAINING FOODS

Food	Serving Size	Approximate Iron (milligrams)
Beef liver, cooked	3oz	5.8
Lean sirloin, cooked	3 oz	2.9
Lean ground beef, broiled	3 oz	1.8
Skinless chicken breast, dark meat, roasted	3 oz	1.1
Skinless chicken breast, white meat, roasted	3 oz	1.0
Pork, lean, roasted	3 oz	1.0
Salmon, canned with bone	3 oz	0.7
Fortified breakfast cereal	1 cup	4.5-18
Pumpkin seeds	1 oz	4.25
Bran	½ cup	3.5
Blackstrap molasses	1 tbsp	3.5
Soybean nuts	½ cup	4.0
Spinach, cooked	½ cup	3.2
Red kidney beans, cooked	½ cup	2.6
Prune juice	¾ cup	2.3
Enriched rice, cooked	½ cup	1.2
Raisins	1/3 cup	1.1
Prunes, dried	5	1.1
Whole wheat bread	1 slice	0.9

## APPENDIX D. NUTRITION RESOURCES

### DIETARY SUPPLEMENTS WEBSITES

Food and Drug Administration  
<http://www.cfsan.fda.gov/~dms/supplmnt.html>

Federal Trade Commission  
<http://www.ftc.gov>  
<http://www.ftc.gov/opa/1999/9911/astmetrx.htm>

US Air Force USAFSAM/AF  
<http://www.brooks.af.mil/web/af/altmed/HOMEFRAME.htm>

National Center for Complementary and Alternative Medicine  
<http://nccam.nih.gov>

American Botanical Council  
[www.herbalgram.org](http://www.herbalgram.org)

Office of Dietary Supplements, National Institutes of Health  
<http://dietary-supplements.info.nih.gov>

Uniformed Services University of the Health Sciences, Human Performance Lab, includes "Nutritional Ergogenic Agents: A Compendium for the Special Operations Command," "Navy Seal Nutrition Guide" & "Navy Seal Physical Fitness Guide"  
<http://www.usuhs.mil/mim/hpt.html>

Health World On-Line  
[www.healthy.net](http://www.healthy.net)

Consumer Labs  
<http://www.consumerlab.com>

### HEALTH AND NUTRITION WEBSITES

American Heart Association  
<http://www.americanheart.org>

American Dietetics Association  
<http://www.eatright.org>

Calorie Control Council  
<http://www.caloriecontrol.org/>

Shape Up America  
<http://www.shapeup.org/>

American Diabetes Association  
<http://www.diabetes.org>

The Mayo Clinic Health Oasis  
<http://www.mayohealth.org>

Weight Information Network  
National Institute of Diabetes, Digestive & Kidney Diseases  
<http://www.niddk.nih.gov/>

Soy Foods Web Site  
[www.soyfoods.com](http://www.soyfoods.com)

National Heart, Lung, and Blood Institute: Information Center  
[www.nhlbi.nih.gov/nhlbi/nhlbi.htm](http://www.nhlbi.nih.gov/nhlbi/nhlbi.htm)

Federal Trade Commission  
[www.ftc.org](http://www.ftc.org)

Gatorade Sports Science Exchange  
[www.gssi.web.org](http://www.gssi.web.org)

Sportscience News  
[www.sportsci.org](http://www.sportsci.org)

U.S. Department of Agriculture  
Food and Nutrition Information Center  
<http://www.nal.usda.gov/fnic/>

International Food Information Council  
<http://ificinfo.health.org/>

Wheat Foods Council  
<http://www.wheatfoods.org/>

Navy Environmental Health Center  
<http://www-nehc.med.navy.mil/hp/index.htm>

University of California Berkeley  
Wellness Letter  
<http://www.berkeleywellness.com/>

Tufts University Nutrition Navigator  
<http://navigator.tufts.edu/>

## ABOUT THE AUTHORS

**DR. CAROLYN ALDWIN** received her degree from the Adult Development and Aging Program at the University of California, San Francisco, in 1982. She was an NIMH post-doctoral scholar at the University of California, Irvine, and then took a position as a research psychologist at the Normative Aging Study, Boston VA outpatient clinic. She is currently Professor of Human Development and Family Studies at the University of California at Davis. Currently on the Editorial Board for the *Journal of Gerontology* and *Journal of Psychological Sciences*, Dr. Aldwin has authored over 50 articles and one book, *Stress, Coping, and Development* (Guilford Press).

**LIEUTENANT COLONEL THOMAS J. BALKIN**, Ph.D., is the Chief, Department of Neurobiology and Behavior in the Division of Neuropsychiatry at Walter Reed Army Institute of Research. His expertise is in the neurophysiological correlates of sleep and wakefulness; functional brain imaging (regional cerebral blood flow changes) across various stages of sleep and wakefulness; and the nature and function of sleep for sustaining cognitive performance.

**COLONEL WILLIAM F. BARKO**, M.S.W., is the Director, Army Physical Fitness Research Institute at the U.S. Army War College in Carlisle, Pennsylvania. He has over 20 years experience in applied behavioral science research. Colonel Barko has served as an associate editor of the *Journal of Applied Behavioral Science* since 1990 and has numerous publications in the area of organizational development, leadership, and stress. He has been active for many years as a track and field coach and presently serves as an assistant coach at Messiah College.

**LIEUTENANT COLONEL GASTON P. BATHALON**, Ph.D., is a Registered Dietitian (R.D.) currently assigned as the Senior Operational Nutrition Research Staff Officer at the U.S. Army Research Institute of Environmental Medicine in Natick, Massachusetts. His research interests include weight control, body composition assessment, and energy expenditure. LTC Bathalon is a member of the American Dietetic Association. He received his B.S. in Human Nutrition and Foods from the University of Vermont and an M.S. and Ph.D. in Human Nutrition Sciences from Tufts University.

**COLONEL MICHAEL P. BRAZAITIS**, M.D., currently serves as Chairman of the Department of Radiology at Walter Reed Army Medical Center and as the Radiology/Teleradiology Consultant for the North Atlantic Regional Medical Command. He has developed and is presently implementing a plan to install a Digital Imaging Network Picture Archiving and Communication System (DINPACS) throughout the North Atlantic region, encompassing 19 clinical sites. Dr. Brazaitis has managed the Heart-View™ Early Diagnosis and Screening Service (EBCT) at Walter Reed for the past 3 years, a program that has scanned almost 9,000 patients to date. A graduate of Fordham University and Columbia University, he received his Medical Degree from Georgetown University in 1980. He is board certified in Diagnostic Radiology and completed a Fellowship in Cross-Sectional Imaging at Johns Hopkins University in 1992.

**COLONEL GREGORY BELENKY**, M.D., is the Director of the Division of Neuropsychiatry at the Walter Reed Army Institute of Research and Professor in the Department of Psychiatry at the Uniformed Services University of the Health Sciences. He is a Fellow of the American Psychiatric Association. Colonel Belenky's research interests include sleep, sleep deprivation, and continuous operations; combat stress reactions and post-traumatic stress disorder; and the neurobiology of human behavior and adaptation. In addition to authoring numerous journal articles, he has edited two books on combat psychiatry (*Contemporary Studies in Combat Psychiatry*, Greenwood Press, 1987, and *The Gulf War and Mental Health: A Comprehensive Guide*, Praeger Press, 1996.)

**DR. JEFFREY BOONE**, M.D., is an Assistant Clinical Professor of Medicine at the University of Colorado School of Medicine in Denver, Colorado. He also serves as a consultant in Preventive Cardiology, Stress Medicine, and Hypertension at Colorado Heart Imaging in Denver, Colorado. His primary focus is on topics related to the cardiovascular consequences of mental stress and intensity, stress medicine, hypertension, preventative cardiology, exercise, and the uses of advanced cardiac imaging in the prevention of heart disease. Dr. Boone has delivered presentations on these topics on four continents and in 47 states.

**DR. VAUGHN CALL** is Professor and Chair of the Department of Sociology at Brigham Young University. Dr. Call is a nationally recognized expert in survey research methodology and has more than 20 years of experience directing surveys at the national, state, and local levels. While at the University of Wisconsin-Madison, he helped direct one of the largest national longitudinal surveys on the American family ever conducted. He recently helped direct the community interviews and the high school survey for the "End of the Century" study of "Middletown." This classic study of a typical American community started in the 1920s and was followed up in the 1930s, 1970s, and 1980s. The 1999 "Middletown" study will be part of a Public Broadcasting Corporation (PBS) special on change in America over the last century.

**DR. JOHN DUNCAN** is Professor of Clinical Research at Texas Woman's University in Denton, Texas. He was chief of clinical applications at the Cooper Institute for Aerobics Research in Dallas, Texas, for over 15 years and is currently president of Wellmart, Incorporated. He has published over 30 papers focusing on the public health implications of exercise, with special emphasis on the role of exercise, diet, and life-style in the prevention and treatment of chronic diseases, particularly coronary disease. Dr. Duncan also has considerable experience in the evaluation and design of sports medicine programs for elite, Olympic, and professional athletes, including the Dallas Cowboys, Texas Rangers, and the 1994 U.S. World Cup Soccer team. He has contributed over 120 health-related stories to the national media, including the *New York Times*, the *Wall Street Journal*, CBS, CNN, and National Public Radio. He currently hosts "On Target: Your Health with Fitness Doctor John Duncan" on two radio affiliates in Dallas.

**DR. IRWIN FEUERSTEIN**, M.D., is the Chief, Electron Beam Computed Tomography (EBCT) in the Department of Radiology at Walter Reed Army Medical Center. He is a Visiting Scientist at the National Institutes of Health in Bethesda, Maryland, as well as a Consultant in Diagnostic Radiology at Bethesda Naval Hospital. Dr. Feuerstein is also



Associate Professor of Diagnostic Radiology at the Uniformed Services University of the Health Sciences in Bethesda. He is responsible for much of the groundbreaking research at the University of California, San Francisco, in the fields of computed tomography and ultrafast CT scanning, and is recognized among the world's foremost authorities in its applications.

**DR. EDWARD A. FRANCO** is a clinical psychologist in private practice. He received his Ph.D. from the University of Maine and has been engaged in full-time practice since 1977. Following his longstanding interest in the psychophysiological effects of stress, he has been actively involved in the areas of biofeedback, stress management, and cardiac rehabilitation. He also specializes in offering group interventions aimed at the prevention of cardiac disease with high risk individuals. Since 1987, Dr. Franco has owned and directed Franco Psychological Associates, a group practice of thirteen professionals providing a full range of psychotherapy services to children, adolescents, and adults.

**CAPTAIN LORI D. HENNESSY**, M.H.A., is a Registered Dietitian (R.D.) currently stationed at the Army Physical Fitness Research Institute at the U.S. Army War College in Carlisle, Pennsylvania. She is certified by the American College of Sports Medicine as a Health/Fitness Instructor and holds a master's degree in Health Administration. She is a part-time nutrition lecturer at Penn State Capital College in Harrisburg, Pennsylvania.

**DR. JOSEPH KNAPIK** is a retired U.S. Army officer currently serving as a research physiologist at the U.S. Army Center for Health Promotion and Preventive Medicine, Directorate of Epidemiology and Disease Surveillance, Aberdeen Proving Ground, Maryland. His research and educational activities have included investigating risk factors for musculoskeletal injury, developing injury surveillance systems, promulgating innovative methods for safe physical training, enhancing human performance in harsh environments, assessing the ergonomic viability of equipment, and studying fitness and injury in older populations. He is a member of the Order of Military Medical Merit and a Fellow of the American College of Sports Medicine.

**MAJOR REBECCA L. MCCOLLAM**, PT, MSA, is a physical therapist in the U.S. Army Medical Specialist Corps and currently serves as the Deputy Director, Outreach and Operations, of the Army Physical Fitness Research Institute at the U.S. Army War College. Her expertise is in the evaluation, treatment, and prevention of orthopedic and sports-related injuries. Major McCollam recently completed a Flexibility and Injury Prevention module for APFRI's upcoming interactive CD-ROM.

**DR. MICHAEL W. PARKER, SR.**, (Lieutenant Colonel, U.S. Army, Retired), D.S.W./Ph.D., Board Certified Diplomate, ACSW, LCSW, PIP, is assistant professor in the School of Social Work at the University of Alabama in Tuscaloosa and the University of Alabama Medical School's Center for Aging and Department of Geriatrics and Gerontology (Birmingham). He is a co-investigator on a National Institute of Aging longitudinal study of mobility and health among seniors in Alabama, and is the primary investigator on a health promotion study among senior leaders in the Department of Defense. His specialty areas are successful aging,

parent care and long-distance caregiving, the relationship between faith and health, and health promotion models that prepare people for the next season of life.

**DR. ARON W. SIEGMAN** is Professor of Psychology at the University of Maryland, Baltimore County, where he was chairman of the Psychology Department (1971-78) and Director of its Behavioral Medicine Program (1990-95). Prior to joining the University of Maryland, Baltimore County, he was Research Professor of Medical Psychology at the University of Maryland School of Medicine, and on the faculty of the University of North Carolina (Chapel Hill) and Bar-Ilan University (Israel). His current major research interest is in the role of personality and negative emotions, especially anger, in coronary heart disease. He is the author of numerous journal articles and co-editor of several books in the areas of expressive behavior and behavioral medicine.

**LIEUTENANT COLONEL MARK A. VAITKUS**, Ph.D., is a research psychologist in the U.S. Army Medical Service Corps and currently serves as Deputy Director of the Army Physical Fitness Research Institute at the U.S. Army War College in Carlisle, Pennsylvania. He has served as a researcher with the Walter Reed Army Institute of Research and taught leadership at the United States Military Academy. His published work has focused on cohesion, morale, and organizational health.

**LIEUTENANT COLONEL NANCY J. WESENSTEN**, Ph.D., is a research psychologist, Department of Neurobiology and Behavior in the Division of Neuropsychiatry, Walter Reed Army Institute of Research. Her expertise is in the field of behavioral (cognitive performance) consequences of sleep deprivation, sleep restriction, and sleep disruption; neuropharmacology of sleep and wakefulness; and the sustainment of soldier cognitive performance through pharmacological enhancement of sleep and wakefulness.

**DR. REDFORD WILLIAMS**, M.D., is Professor of Psychiatry at Duke University Medical Center, as well as the Director of the Behavioral Research Center at Duke. He received his M.D. from Yale Medical School and has over 100 published articles. He is among the world's leading researchers in the relationship of anger and hostility to disease. With his wife, Dr. Virginia Williams, he has co-authored *Anger Kills* and *Lifeskills*, two highly successful books that have practical utility for both individuals and couples. Dr. Williams has appeared on national television, in such shows as *Good Morning America*, *The Today Show*, *Oprah*, and *20/20*.

**COLONEL JEREL M. ZOLTICK**, M.D., is the Senior Flight Surgeon and Cardiologist at the U.S. Army Surgeon General's Office. He received his M.D. and F.A.C.C. from the College of Physicians and Surgeons at Columbia University. Dr. Zoltick follows patients both at the U.S. Army Health Clinic at the Pentagon and Walter Reed Army Medical Center. He has conducted maximal treadmill testing at the Army War College since 1982 and participated in many major cardiac research studies.

**APFRI STAFF**

**Colonel William F. Barko  
Director**

**Lieutenant Colonel Mark A. Vaitkus  
Research Psychologist**

**Major Rebecca L. McCollam  
Physical Therapist**

**Major Ruth G. Crampton  
Family Nurse Practitioner**

**Captain Lori D. Hennessy  
Registered Dietitian**

**Ms. Melanie T. Richardson  
Health & Fitness Instructor**

**Ms. Nancy S. Henry  
Health & Fitness Instructor**

**Sergeant First Class Frank Hughes  
Physical Therapy Technician**

**APFRI WEBSITE  
[www.carlisle.army.mil/apfri](http://www.carlisle.army.mil/apfri)**