Chapter 14

HEALTH, FITNESS, AND NUTRITION

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Nations have passed away and left no traces, and
history gives the naked cause of it;
One single simple reason in all cases - they fell
because their people were not fit.

Rudyard Kipling

INTRODUCTION

"Pilot failure results from ignorance, carelessness, disobedience, bad judgment, and poor physical condition. In the campaign to defeat these enemies of safety, proper authorities have prescribed rules, regulations, and standard practices, but they can only point the way--safety of flight depends on the crew--know the rules, abide by the rules, keep constantly on the alert, use considered judgment, keep yourself physically fit, and plan in advance for possible emergencies. Work out in your own mind procedures you plan to follow for each." (28)

This was advice given to fliers by the U.S. Army Air Forces during World War II. The responsibility for pilot failure belongs to both the pilot and the flight surgeon. The flight surgeon understands the importance of flying effectiveness, mission efficiency, and flying safety. The flight surgeon gives the medical care and advice for the flier to remain in good physical and mental condition and to maintain the total readiness required. (28)

Operational Stress

Accidents and incidents will continue to occur because humans cannot fully accommodate themselves to the stresses of flight: acceleration, hypoxia, noise, vibration, decreased barometric pressure, circadian rhythm, temperature, humidity, and fatigue. These stresses are discussed elsewhere in this publication. Healthy and fit fliers are sought who are most resistant to these stresses. The flight surgeon's duty is to detect and treat illnesses as well as enhance and maintain optimal health and fitness in the fliers that have reduced their resistance to these stresses. (44) The various operational stresses are the subjects of many of the other chapters in this guide.

Self-Imposed Stress

Unfortunately many fliers lower their resistance to the "operational stresses" by self-imposed unhealthy behavior patterns and lifestyles such as self-medication, alcohol and drug abuse, smoking, improper nutrition, physical inactivity, and obesity. The flight surgeon's task is not only to cure disease but to keep the flier healthy. The flight surgeon is in a unique position to maintain aircrew health since they attend squadron briefings and social functions and see them in the office, etc. In other words, the flight surgeon has the capability to practice preventive

medicine. Physical fitness, nutrition, sleep and circadian rhythm disturbance, and health promotion intervention programs will be discussed in the chapter.

PHYSICAL FITNESS

Considerable technical skill and muscular coordination are required to fly. However, flying is a relatively sedentary occupation. Except for flying high G, high performance aircraft (see below) or situations requiring escape, evasion, and survival, military flying does not require unusual physical strength and endurance. Because of this relatively sedentary occupation, the flier may find it difficult to maintain a desirable weight or to retain good muscle tone and endurance without some form of regular exercise. With regular exercise the flier may find relief of daily tensions and frustrations replaced by more healthy physical fatigue. The flight surgeon should be knowledgeable concerning physical conditioning to advise the aircrewmember on improving and maintaining physical fitness. (28)

Anaerobic (Muscular) Conditioning

Muscular strength is most effectively developed when the muscle or muscle group is progressively and temporarily overloaded ("progressive resistance training"). Strength development is specific to the muscle groups being exercised and to the pattern of movement performed. For this reason, it is important to perform a variety of exercises using all of the major muscle groups to ensure total body conditioning. (3) (38) A workout program for **High Intensity Muscular Conditioning** is provided in **Attachment 1** at the end of this chapter

Aerobic Conditioning

Aerobic exercise is that type of exercise which, according to Cooper (25), "demand large quantities of oxygen for prolonged periods and ultimately force the body to improve those systems responsible for the transportation of oxygen." The cardiovascular system is conditioned to supply adequate oxygen to the exercising muscles. Different aerobic exercises (e.g., running, swimming, etc.) can be compared by looking at the amount of oxygen necessary to perform the exercises at a certain intensity and duration (time).

The American College of Sports Medicine makes the following recommendations for the quantity and quality of training for developing and maintaining cardiorespiratory fitness, body composition, and muscular strength and endurance in the healthy adult. (70)

1. ***Frequency of training***: 3-5 days per week.
2. ***Intensity of training***: 50-85% of maximum oxygen uptake or HRmax reserve or training heart rate. An accurate formula for determining a “training sensitive zone” should be provided. Simply taking a percentage of maximal heart rate will provide an UNDERestimation of the training intensity. It is important that “resting heart rate” is considered in the calculation of training intensity based on heart rate to provide a target training heart rate based on maximal heart rate reserve.

The following equation (Karvonen formula) should be used for determining 'target' or training heart rate (THR):

THR = [%VO2max (Hrmax - Hrrest)] + Hrrest

where: THR = training heart rate
%VO2max = the training intensity that is selected
Hrmax = maximal heart rate = 220 - age
Hrrest = resting heart rate measured in the standing position

For example: Say a 30 year old pilot wanted to train at 70% of their maximal capacity. If he/she simply took 70% of estimated maximal heart rate (220-30 = 190 bpm), they would train at a THR of 133 bpm. Now say he/she measured a standing resting heart rate of 70 bpm and applied the Karvonen formula. Their THR would be calculated to be [0.7(190-70)] + 70 = 154 bpm. One can back-calculate the original THR of 133 bpm to determine that in fact this would only represent 53% of maximal capacity when the individual was striving for 70%! (71)

3. ***Duration of training***: 20-60 minutes of continuous aerobic activity. Duration is dependent on the intensity of the activity; thus, lower intensity activity should be conducted over a longer period of time. Because of the importance of "total fitness" and the fact that it is more readily attained in longer duration programs, and because of the potential hazards and compliance problems associated with high intensity activity, lower to moderate intensity activity of longer duration is recommended for the nonathletic adult.

4. ***Mode of activity***: any activity that uses large muscle groups, can be maintained continuously, and is rhythmical and aerobic in nature, e.g., walking-hiking, running-jogging, cycling-bicycling, cross-country skiing, dancing, rope skipping, rowing, stair climbing, swimming, skating, and various endurance game activities.

5. ***Resistance training***: Strength training of a moderate intensity, sufficient to develop and maintain fat-free weight should be an integral part of an adult fitness program. One set of 8-12 repetitions of eight to ten exercises that condition the major muscle groups at least 2 days per week is the recommended minimum.

Diet influences fitness levels as shown in a study presented to the Air Force Nutrition Committee on the effects of diet counseling on predicted VO2 max. (19). Persons whose diets followed the food guide pyramid significantly improved their VO2 max compared to those who did not.

Physical Fitness and G Tolerance

The relationship between physical fitness and G tolerance of aircrew of high performance fighter aircraft has been a subject of investigation and discussion for many years. Some of these pilots experience rapid onset G loads equal to or greater than 9 G for sustained periods. Local muscle fatigue may result from the M1 or L1 respiratory and muscle straining maneuvers used to

maintain adequate cerebral blood flow during high G. (21) There is evidence that resistance (strength) training can increase the time to fatigue during simulated aerial combat maneuver (SACM) (21,27,49,75). However, recent experiments demonstrated that the inability to continue to perform anti-G straining maneuvers during a SACM was not likely due to central nervous system fatigue (74) or to fatigue of large skeletal muscle groups usually involved in resistance training (72-74). These results, taken together with data indicating that the force levels generated in large muscle groups during SACM are submaximal (72-74), question the rationale for advocating training for increased strength for the purpose of improving tolerance to +Gz acceleration forces. The emphasis on resistance training for high-G tolerance might be better placed on endurance resistance conditioning rather than strength and power regimens of the large skeletal muscles and endurance training of respiratory muscles (74).

Over the past half century, anecdotal reports have described common experiences of dizziness, nausea, and symptoms of syncope in endurance-trained athletes. From these observations emerged the hypothesis that aerobically-fit individuals may be predisposed to orthostatic hypotension and intolerance to high G. Although numerous investigations reported in the literature have failed to support this hypothesis (27,52,78-84,86,90), there are a few studies that indicated that individuals who habitually participate in endurance exercise training have demonstrated some degree of symptomatic orthostatism (77,78,85,87,89). On the basis of such evidence, a 1989 Tactical Air Command Recommendation (recently renumbered as ACCR5117) limited the amount of aerobic exercise for pilots at 20-30 minutes, 3 times per week for no more than 9 miles per week.

The mechanisms underlying syncope in some highly aerobic-trained individuals are unclear. An early cross-sectional investigation demonstrated that lower orthostatic tolerance was associated with greater venous compliance in the legs of athletes compared to unfit subjects (87). However, more recent studies have failed to support this relationship. Although it has been hypothesized that high cardiac vagal tone may be a possible mechanism that limits the ability of athletes to increase heart rate and may cause G-induced marked sinus bradycardia, AV dissociation, and asystole(52,77), there is no direct evidence to support this. One possible hypothesis is that athletes have attenuated carotid and aortic baroreflex responsiveness for inducing tachycardia (89). However, cross-sectional and longitudinal data have demonstrated little difference in cardiac baroreflex function associated with endurance exercise training (78,79). Further, expanded blood volume, which is associated with endurance exercise training, is known to reduce heart rate and vasoconstrictive baroreflex responses to baroreceptor stimulation (78,79,88). Since lower orthostatic tachycardia observed in highly aerobic-trained individuals is compensated for by higher stroke volume (85), cardiac output is maintained at or above levels of unfit subjects.

With the lack of evidence to support the role of increased venous pooling and attenuated baroreflex function in athletes to explain their predisposition to syncope, a new hypothesis has emerged which describes evidence that athletes have structural changes in the cardiovascular system that, although beneficial during exercise, can lead to an excessively large decrease in stroke volume during orthostatism. This hypothesis is based on the evidence that endurance-trained athletes demonstrate a greater effective left ventricular compliance and distensibility than

nonathletes and a steeper slope of the Frank-Starling relationship between left ventricular filling pressure and stroke volume (85). When central blood volume and cardiac filling pressures are reduced by a gravitational challenge under the mechanical condition of the athletic heart, the resulting reduction in stroke volume will be dramatically greater than that of a sedentary individual. Thus, a greater capacity for reduction in stroke volume for the same reduction in filling pressure may represent the most likely mechanism to predispose the athlete to syncope.

The concern of syncope in the athlete is a complex one that clearly is not linear, i.e., there is not a direct relationship between fitness and orthostatic intolerance, and may be most appropriately characterized as a shallow "U" shape with the incidence of orthostatic intolerance at both ends of the spectrum. Thus, both very fit (e.g., endurance athletes) and the unfit (e.g., individuals restricted to inactivity) may be prone to adverse reactions during high G exposure. It should be emphasized that incidences of syncope in athletes occur in a very select few of highly endurance-trained individuals usually with maximal oxygen uptake (VO2 max) above 60-65 ml/kgxmin (78). Since there is an important genetic component to being an elite athlete, it is not unreasonable to speculate that a steeper Frank-Starling curve may be an innate characteristic of some athletes, thus predisposing then to low tolerance during G stress. In addition, an athlete's large ventricular volume and compliance may result from years of exposure to high intensity training. The phenomenon of syncope in the elite athlete most likely represents a mechanical change in the cardiovascular system that benefits the athlete during exercise and should not be interpreted as a clinical abnormality. Since it is highly unlikely that Air Force pilots with average VO2max of 48 ml/kgxmin (76) can induce such myocardial changes with endurance training, it is important that the predisposition to G-induced syncope present in a few elite athletes not detract from the health benefits to be gained by USAF aircrew and ground-support personnel who undertake aerobic exercise programs. It should be emphasized that all cross-sectional (52,81,83,84,90) and longitudinal (27,80,82,86) investigations have failed to demonstrate any detrimental relationship or effect of aerobic conditioning on +Gz performance. Based on our present understanding of underlying physiological mechanisms of blood pressure control, their adaptations to exercise training, and data from investigations of the relationship between G-tolerance and aerobic fitness, there is no evidence to justify restrictions to aerobic endurance exercise in moderately fit high-performance aircraft pilots.

NUTRITION

Basic Nutrition

Major Nutrients. Major nutrients and basic nutrition in general are covered extensively in numerous sources. U.S. Air Force dietary publications include AFI 44-141, Nutrition Allowances, Standards and Education and AFP 50- 45, Wellness Lifestyle Guide For Personal Readiness. Katch and McArdle (38) and Cooper (25) are two good non-military sources. Attachment II provides a short review of pertinent, simple information concerning major nutrients and diet in general. It can also serve as a basis for a flight surgeon's briefings. The AFPAM 44-XX series provides several useful guides for providers and patients.

Recommended Dietary Allowances. The nutritional requirements of the aircrewmembers differ very little from standard recommended dietary requirements. (28) Recommended Dietary Allowances, Revised 1989, (46) contain detailed recommendations for dietary intake of calories, carbohydrates, fats, vitamins, minerals, electrolytes, and water. AFR 160-95 (new AFI # not yet available) recommends recommended dietary allowances (MRDA). (8)

Special Nutritional Considerations

Expansion of Intestinal Gas. Fighter pilots and some bomber and reconnaissance crews may require special diet control to reduce the incidence of gas pains and improve crew effectiveness at high altitudes. This same diet control would also be needed when preparing for altitude chamber flights conducted as part of physiological training. The expansion of abdominal gases at high altitude may cause an uncontrollable feeling of fullness, and in some cases, painful cramps. (15,28)

Specific fixed diets are not entirely satisfactory because of the marked variability in food tolerances and preferences between individuals. Balanced meals containing good quality protein, as well as carbohydrate, and also free of foods producing flatulence or bulk in the colon, are considered generally acceptable.

Items contraindicated, because they induce abdominal gas, include vegetables of the cabbage family, dried peas and beans, beer or carbonated drinks, turnips, rutabagas, and other raw fruits and vegetables which are fibrous. Ground beef which contains textured soy proteins should also be avoided. Soy protein has been added to ground beef to reduce food cost; however, increased flatulence may be associated with such soy-extended products.

The chewing of gum is also discouraged since it promotes air swallowing. Many fresh fruits and fruit juices are permitted. High-fat, heavily spiced, or poorly cooked food items are less readily digested, and generally should be avoided by aircrews. Field reports indicate that the occurrence and severity of gastric distress in flying are quite low when moderate dietary precautions are taken. Finally, drugs such as sodium bicarbonate or other effervescent powders should not be used. (15)

Dehydration. A situation with possible inadequate cockpit or cabin cooling coupled with the slow relative humidity at high altitude can produce dehydration. Thirst is not a good indicator of fluid requirements especially during periods of intense stress. Dehydration can result in decreased coordination, narrowed span of attention, and acceptance of lower standards of performance. Water losses need to be corrected by drinking fluids such as water and juices, at frequent intervals. (15,32) Weight determination before and after a flight or exercise session may be beneficial for some to illustrate or determine fluid losses and replacement requirements (approximately 16 oz. water for every pound lost).

Caffeine. Being a stimulant, caffeine can cause an increase in heart rate, restlessness, nervousness, or anxiety. It comes from the coffee bean, tea leaf, kola nut, and cocoa bean and is found in coffee, tea, cocoa, chocolate, colas, soft drinks, and some medications. A flier should

avoid an excessive intake of caffeine. Attachment VI contains the caffeine content of some common foods and medications. Attachment VII shows caffeine content of soft drinks. (15)

Licorice. This is extracted from natural sources, contains a substance called glycyrrhizic acid that, when consumed in excessive amounts, has caused potassium depletion, with resultant muscle disease and has also been associated with sodium and water retention, the aggravation of hypertension, abnormal sensations, such as burning or prickling, and changes in body chemistry. An excessive intake could also counteract the effect of medications for hypertension.

Licorice is a flavoring ingredient in candy, alcoholic beverages, and drugs. Most American manufacturers use a synthetic licorice flavor in making various candies. However, many imported varieties of licorice candies, especially those from Italy, France, Holland, and Switzerland, contain the natural extract. Excessive consumption of such imported candies may be contraindicated in patients with chronic cardiovascular disease who take potassium-wasting diuretics, or who are on sodium restricted diets. (15)

Flight Feeding

Flight feeding is considered in three categories: preflight, inflight, and postflight. These are specialized extensions to the basic program of nutrition on the ground. All have become increasingly necessary in recent years because of the extended ranges and performance of modern aircraft.

It is recognized that flying activities often interrupt and modify the fundamental living habits of personnel, including those of sleeping, eating, or drinking. The primary purpose behind flight feeding effort is, to assist aircrews and also aircraft passengers in their adjustment to these work demands.

Field observations from various sources have indicated that "nonfeeding," or irregular eating practices over an extended period, contribute to fatigue, human error, and possible aircraft accidents. The value of flight feeding with respect to general bodily comfort and morale is even more commonly recognized. To promote the best in performance, the flight feeding system should properly "refuel" the human operators with nutrients, on a careful and regular basis, just as an aircraft is refueled.

The three categories of flight feeding are regarded as consecutive phases, differing only in details of purpose and methods of accomplishment. Preflight and postflight feeding are implemented through ground-kitchen facilities. They may be readily available and effective at some Air Force bases, but not available at others. In-flight feeding is comparatively more difficult because the limitations of the aircraft restrict food preparation and consumption. The two ground phases should therefore be planned to counterbalance and compensate for any in-flight periods.

Food servicing is often a matter of individual responsibility. Personnel frequently obtain separate flight subsistence from Air Force supply sources, commercial stores, restaurants, or their

respective homes. This means that all aircrewmembers should be educated to follow conscientiously a good dietary pattern.

Preflight Feeding

Effective preflight preparations require that each person boarding an aircraft should consume a freshly-prepared, balanced meal an hour or two before expected takeoff. This usually is a breakfast menu of fairly light proportions, even though it may be scheduled at various times of day or night. Under pleasant, unhurried eating conditions, a desirable relaxation and regularity of digestion are encouraged. (4) Gas producing foods should be avoided. Alert aircrew feeding is a special situation of preflight feeding. When crewmembers are on alert status, they are restricted to the alert crew facility and must be ready at all times for immediate takeoff. Alert aircrewmembers are subject to the unnatural stresses caused by high altitudes, high-speed flights, and long periods of constant fatigue, poor digestion, emotional straining, and physical stress. Proper diet helps to prevent these problems. Proper diet also checks the tendency of the aircrews to gain weight because of the sedentary nature of combat alert duty. AFI 34-401, Food Service Management, discusses dining facilities for this situation both preflight and postflight. AFI 40-104, Nutrition Education, with reference to AFR 160-95 (new AFI # not available), describes the special diet requirements that are necessary for a person performing sedentary duties. Foods should provide the recommended daily allowances but should exclude those which commonly cause digestive disturbances.

Inflight Feeding

Inflight feeding is a rather new development in comparison with other aircraft procedures. Early aircraft had short flight durations which did not require organized feeding in the air. The importance and need for such provisions became apparent during World War II. The present concepts of in-flight nutrition have evolved from the increasing requirements of aircrews for longer missions. Some degree of in-flight feeding is now routine in many Air Force operations.

The factors which influence the extent and success of food servicing in an aircraft are numerous. Meals eaten aloft are often a nutritional compromise with the practical realities of limited aircraft space, equipment, and other demands of the flying situation. Accordingly, no single method of in-flight feeding or standard type of food packaging can completely fulfill all of the changing needs of fliers. The satisfactory feeding operation must feature simplicity, ease of support, and a variety of well-liked foods and beverages in attractive combinations. To some extent, this requires a different "prescription" of meal types and food servicing equipment for each model aircraft and also for each kind of flight mission.

Air Force equipment directives plan for drinking fluids to be supplied in all aircraft capable of flying over 3 hours, in quantities of 1 quart per crewmember or passenger for each 16 hours of flight. Flight lunch storage and heating facilities are similarly scheduled for aircraft with over 6 hours flight duration, on the basis of one added meal for each subsequent 6 hours. This criterion serves only as a guide for the initial authorization, design, and production of feeding apparatus or food packets. (4)

These planning figures will be much more flexible as the actual feeding practices are worked out within the operational Air Force commands. For example, the aircraft flight time has not proved a true index for in-flight feeding. The "flight duration" for this purpose should be the total time from the preflight breakfast (or last meal before takeoff) to the end of postflight debriefing or interrogation. (32)

Field observations show trends in aircrew feeding habits that are common enough between Air Force commands to be classed as "in-flight peculiarities." The appetites of crew personnel usually decrease, especially in the final hours of long flights, and food items are regarded more critically. Features of the military aircraft environment, such as work concentration, noise, vibration, decreased oxygen, etc., all tend to reduce the digestive processes. The extreme tensions of air emergencies and active combat may completely inhibit gastric function.

Monotony of diet is a further in-flight problem for aircrews, which does not apply to air-borne troops and passengers who travel less frequently. Passenger personnel generally consume heavier meals, presumably to relieve flight strain or tedium. Their eating also prevents the "emptiness" and other gastric discomfort which seem to predispose to airsickness in certain susceptible individuals.

Approximately 6 hours are recommended between in-flight meals (AFR 146- 15) but small amounts of "free choice," sugar-yielding food supplements may be desirable between the meal periods. Beverages are most important and should be freely available at all times. These factors are presented as a guide to the average in-flight practices of the majority of operational personnel, rather than as arbitrary and fixed requirements.

Types of Flight Meals Authorized. Flight meals authorized in the Air Force flight feeding system are listed below:

a. Sandwich/Entree Meal
b. Meal, Cooked, Frozen
c. Bite Size Meal
d. Meal, Ready-to-Eat (MRE)
e. Snack Meal.
f. Bulk items for preparation aloft.
g. Hospital Patient Flight Meal

For a description of these meals the reader is referred to AFI 34-401. There are also lower caloric meals available for those on a weight control or reduction program.

Beverages. Dehydration of the human body results in lowered efficiency and is a serious factor for flight operations in hot climates or at high altitude. Cool water, coffee, tea, fruit juices, "Gatorade" and "Koolaid" are all popular but the caffeine content of coffee and tea should not be overlooked. Cool water should always be available, and other beverages should be available on missions of more than a few hours. Beverages should also be included with flight meals.

New Foods for Special Aerospace Operations. Low-moisture foods have been developed for feeding systems in space vehicles where the environment, weight, and volume limitations have required highly stable, lightweight rations which require minimum preparation. These feeding systems are composed of bite-size dehydrated foods, rehydratable precooked freeze-dried foods, and rehydratable beverages. These foods packaged in flight-qualified packaging material are stable for 2 years or longer at room temperature. Tube foods and rod-shaped foods have been developed and are currently being used for operational aircraft (e.g., U-2, TR-1) which require wearing of a full-pressure suit.

Microbiology of Flight Meals. Food-borne infections are always distressing and become particularly serious when the symptoms develop during flight. These may occur when the perishable components of preflight and in-flight meals are improperly handled. Continuous preventive control is necessary, including ground-kitchen sanitation and refrigerated storage of packaged in-flight meals on the flight line or aboard aircraft. This involves the time-temperature factors of bacterial growth in foods prior to consumption and also the design, use, and cleaning of all servicing equipment.(9)

Postflight Feeding

The postflight phase depends considerably upon the physical and mental condition of the returning aircrew, as affected by the operating and nutritional demands of the completed flight period. Postflight feeding stimulates both physiological processes and morale, helping to shorten time lost between missions and to prevent chronic fatigue. For these reasons, it should not be long delayed, and convenient flight-line kitchen facilities are a requisite.

One purpose of eating at this time is to relax tensions induced by long hours of alert concentration or other fatiguing flight pressures. Extreme cases may justify the special provision of some light refreshments (for example, beverages, ice cream, or juices) before or during such postflight duties as interrogations. This would be preliminary to a later more complete dinner meal. Some degree of feeding is routinely indicated as the first measure of rest and recuperation.

Between Meal Snacks

For a snack during or between flights, there is a snack meal available in both regular and lower caloric arrangements. Vending machine snacks, such as a candy bar, provide little in the way of nutrients (empty calories). However, there are vending machine snacks that are nutritious: cheese and crackers, peanut butter crackers, fruit or vegetable juice, canned fruit, and milk. (15)

The Feeding of Patients

All diet orders for patients in the aeromedical evacuation system must be specified in accordance with AF Manual 44-139, Clinical Dietetics; AFR 166-6, Cooked Therapeutic Inflight Meals; or AFPAM 44-124, Diet Ordering Guide. AFR 166-6 (new AFI # not available) establishes procedures for planning, ordering, preparing, and serving therapeutic meals for patients on aeromedical evacuation missions. The flight surgeon should refer to these publications for information on this subject.

Survival Feeding

Survival situations are emergencies of bailout, ditching, or other forced landings into primitive isolated regions or behind enemy lines. In the "struggle for existence" toward escape and ultimate rescue, the availability of water and food may be critical. The emergency parachute kits, or life rafts and clothing stowed in military aircraft, are accordingly designed to carry the equipment and the foods necessary for survival.

It is anticipated that survivors will undergo some water imbalance and caloric deficit, ranging downward to possible starvation levels. This will be alleviated over protracted survival periods only to the extent that nutrients can be foraged for the surrounding terrain. For this reason, such items as desalting kits, fishhooks, and hunting gear are included in emergency packs to assist the more fortunate and resourceful individuals in "living off the land." Where the environment is completely nonproductive, the survival-energy potential is limited to the water and food substances that can be carried individually. Special survival-type food packets have been produced specifically to maintain physical condition and morale over the longest possible periods. These are all concentrated foods designed to occupy minimal space in survival packets. The food items are tested for their ability to sustain life in different climatic conditions and for general storage stability which must exceed 2 years.

The survival food packet is a packaged food bar of approximately 400 Kcal derived from carbohydrates. The low protein content spares body water by reducing the obligatory water demand by consuming high protein foods. The nutrient standards for operational and restricted rations do not apply to the survival food packet. This packet is designed to be consumed for periods of less than 4 consecutive days.

Deployment

With the deployment of the squadron, the assigned flight surgeon may find that attention given to the diet of the crew and supporting personnel may help in quickly adjusting their bodies' internal clock to new time zones.

Flight surgeons may also find themselves deployed to remote locations. The nutrient standards for operational and restricted rations and required energy intake in cold and hot environments can be found in AFR 160-95. Meal Ready-to-Eat, Individual (MRE) and Meal Combat Individual (MCI) are described in detail in AFR 146-15 (new AFI # not available). The following is information concerning MREs that is not in the above reference.

At the time of this writing, there are 12 MRE menus. The MRE VIII provides an average of 1298 Kcal with 15 percent protein, 35 percent fat, and 50 percent carbohydrates.(41) Table 14-3 lists the changes scheduled for the contents of the MREs. MRE XIV was implemented in FY 1994, MRE XVI is scheduled for FY 1996. MRE XVII is scheduled for FY 1997 and MRE XVIII is scheduled for FY 1998. (64) The changes to the MRE components are listed in table 14-3.

TABLE 14-1. MRE COMPONENT CHANGES

MRE XIII/XIV

IN	OUT
Smoky franks	Meatballs w/tomato sauce
Pork chow mein	Chicken a la king
Pound Cakes	Nut cakes
Chow mein noodle	Bev. base/sugar-6 menus
Potato sticks	
Fruit-TS (pears, peaches)	
Sugar free bev.	
Heat stable chocolate	

MRE XV

IN	OUT
Grilled chicken	Corned beef hash
Chili macaroni	Omelet w/ham
Fruit-TS (pineapple, mixed)	Fruit-FD
Chewy brownie	Choc. covered brownie
Lemon tea	Coffee-6 menus
Tavern nuts	

MRE XVI(16 menus)

IN	OUT
Grilled beef steak	Potato au gratin
Chicken parmesan	
Pasta primavera (MF)	
Cheese tortellini (MF)	
Mexican rice	
White rice, butter flav.	
Jalapeno cheese spread	

MRE XVII (20 menus)

IN	OUT
Jamaican pork chop/noodles	Escalloped potato w/ham
Beef w/mushroom gravy	Charms
Beef ravioli	Sugar free bev. (possibly)
Turkey breast w/potatoes	
Chicken w/noodles	
Fig bars	
Snacks (corn chips, cheese curls)	
Jolly rancher candy	
Skittles candy or peanut bar	
Apple cider drink	
Beef jerky	

SLEEP and SUSTAINED OPERATIONS

Sleep, like nutrition, is an absolute necessity for life. In fact, it is possible to die from the stress of sleep deprivation sooner than that from food deprivation. Without sleep or with an inefficient or disrupted sleep, we can suffer vigilance problems which can also be life threatening, like falling asleep at the wheel of a car. This section describes what sleep is, what adequate rest is and describes how sleep quality may be improved in individuals suffering from impoverished sleep as a result of transmeridian travel or shift work. It is the responsibility of the flight surgeon to consider inadequate sleep as a potentially serious medical problem, particularly during high intensity or extended operations. The physician must ensure that commanders, ground crew and air crew receive adequate rest.

Sleep is perhaps the easiest of our biological imperatives to satisfy. When denied sleep however, it becomes one of the most demanding and pervasive drives, eventually forcing us to succumb. In addition to the danger of incapacitating lapses into microsleep, the lack of sleep or consistently poor sleep results in increasingly slowed reaction time, error prone performance and irritability. Military personnel often face great potential for disrupted sleep. For example, crews are often required to work during the night, to cross multiple time zones and frequently face stressors that impair restorative sleep. In fact, fatigue may be the most threatening enemy that crews must face in the current military setting. Global reach and global power are concepts that require traveling great distances for long hours in a cramped aircraft to cross multiple time zones. Ground crews and commanders similarly, must bear the added burden of longer hours and fewer personnel.

Most of us function best if we get between 7 and 8 hours of uninterrupted sleep. Sleep should be in a quiet, preferably darkened and comfortable environment, unencumbered by drugs or alcohol. Table 14-4 summarizes the minimum conditions for efficient sleep, which represent good sleep hygiene techniques. Sleep is most efficient during the night time phase of one's circadian sleep/wake cycle (circa= about, dian=day; cycles occurring within a 24 hour period). Crews attempting to operate during the sleep phase, normally at night, risk an increased probability of accidents due to decreased vigilance. Every effort should be made to advise crews to be extremely careful during this circadian performance nadir (0200-0600). The napping strategies outlined below may be useful to crews to get through the circadian performance nadir. It is recommended that at least 2 crewmembers be awake and help each other stay awake at all times of a mission. However, it makes good sense to permit brief naps to help crews function more effectively, particularly at night, as time permits during the mission.

SLEEP STRUCTURE

Sleep is associated with distinct brain electrical patterns on the electroencephalogram (EEG) that occur in cycles or stages. A night's sleep as described by the EEG is remarkably consistent between individuals. Sleep begins with lower frequency and lower voltage EEG patterns of stage 1 compared to our waking state and proceeds over about 60 minutes through slower frequency and higher amplitude patterns of stages 2-4. Stages 3-4 are called singly slow wave sleep (SWS) because of the marked high amplitude slow waves on the EEG. It is believed that slow wave sleep is associated with the replenishment of neurotransmitters and the removal of metabolic by-products. The first slow wave sleep epoch lasts about 15-20 minutes and the EEG patterns become progressively faster and lower in amplitude until a state that resembles an awake EEG is observed. This signals the onset of rapid eye movement sleep (REM), a period of active dreaming which is also called paradoxical sleep because although our EEG looks like an awake state, we are sound asleep as evidenced by the loss of muscle tone during REM. This loss of muscle tone is fortunate because otherwise we might be inclined to act out our dreams and risk injury in our stuporous state. After about 10 minutes of our first REM sleep, we begin to cycle back down to SWS over the next 60 minutes. After the second SWS epoch, after almost 3 hours asleep, the brain spends little time in SWS and instead cycles back and forth from Stage 2 to REM for the remainder of the night. The REM episodes occur more frequently and last about 20-30 minutes after the end of the SWS stages. REM is believed to be the period when events that are important to us are reviewed and perhaps stored as memories. All stages of sleep are important and it can be shown that selectively depriving an individual of a particular stage results in a rebound when the stage is permitted, that is, an increase in time spent in the deprived stage.

NAPPING STRATEGIES.

Crews are sometimes allowed to nap inflight during long missions when possible. Little guidance is provided to the crews about when to nap or how long to nap and these can make a difference in the quality of the nap obtained. Current perspectives on napping suggest that 30 minute naps or naps of about 3-4 hours are much more restorative than naps for any other lengths of time. These are described below as the Short Nap and the Long Nap, respectively. The basis for napping strategies rests in the sleep stages described above. For example, the SWS epoch is the most difficult stage from which to awaken someone. It is apparently difficult for the brain to switch from the giant slow waves (which in an awake person would be a sign of some organic brain dysfunction) to the low amplitude high frequency activity of wakefulness. This difficulty in awakening associated with great sluggishness and impaired mental functioning is called sleep inertia and can last 20 minutes or more after SWS. Sleep inertia is shorter after REM, perhaps as short as a minute or two. The Short Nap and the Long Nap are designed to miss the SWS epoch. The napping strategies are designed to provide an adequate rest while dramatically shortening the time someone who was asleep reaches useful consciousness. These are defined and discussed in

the paragraphs to follow. The physician might be asked to recommend nap strategies such as these to maintain crews for a brief but high intensity operation. You must be able to weigh the absolute necessity for sufficient sleep with the demands and duration of the mission.

The Short Nap

The short nap is defined as less than 40 minutes from the time one begins to attempt sleep to the time of awakening. It is designed to be too short to allow the individual to enter SWS and yet still get a brief, hopefully restorative, nap. Recall the first SWS epoch occurs within about 60 minutes. The Short Nap might be considered a 'combat nap' or a 'power nap' because often times it is enough to provide a few hours of useful wakefulness and yet short enough to prevent an impact on the mission. Research suggests that these naps can provide between 2 to 4 hours of useful physical and mental activity, for about 2-3 days, sometimes longer. After a few days however, cumulative sleep debt would be overwhelming. There are many positions in which these naps would provide relief to crews and improve the quality of their work. Scheduled 30 minute naps might be recommended for shift workers for example, particularly during the midnight shift. It would be a good idea to have 2 people awake at all times while on duty, particularly during the circadian performance nadir (0200-0600) so that they can help each other stay awake. Otherwise, crew naps would be very useful to maintain crew efficiency.

The Long Nap

The long nap is best when more time is available for crew rest during a mission but not enough for a full sleep. Long naps are recommended to be at least 3-4 hours in duration. They are designed to allow the individual to progress through and avoid the SWS epochs. These naps can maintain useful waking performance levels for 4-10 hours and perhaps longer. Although few studies have been done, anecdotal military evidence suggests that 3-4 hour naps can maintain crews for 4-5 days before sleep debt becomes overwhelming. These naps are the most efficient during the circadian performance nadir.

Normal Sleep

The normal sleep period refers to the typical 7-8 hours of sleep that humans need every night. Longer crew rest periods should be recommended, perhaps sleep periods as long as 10-12 hours, in individuals recovering from extended periods of napping, such as during a surge operation. It is also recommended that, prior to any long mission, crews get a long sleep, over 8 hours, to get rid of any sleep debt.

SLEEP DEBT AND DISORDERS

There is good evidence that a large number of people face each day suffering from a sleep deficiency, referred to as sleep debt. Recent magazines have devoted considerable attention to the 'national sleep debt' and its potential costs in productivity loss and ill health. Anyone finding it difficult to remain awake in a darkened lecture room, is likely suffering from sleep debt, not just a boring lecture. The most important piece of advice a physician can provide someone complaining of daytime fatigue or someone preparing for a long endurance mission is to get rid

of sleep debt. Of course, the only way to do this is to get as much sleep as possible and to be as regular about sleep times and procedures as possible.

There are many sleep disorders that cause insomnia. It is possible to provide general, and in most cases, useful recommendations for insomnia without going into a discussion of these various sleep disorders. Sleep debt is only one small manifestation. Sleep hygiene techniques, presented in Table 14-4, will provide relief for many people suffering from insomnia. It would be a good idea to recommend a sleep specialist for individuals who do not find relief from these techniques within a few days. People who find themselves wide awake at night and fatigued during the day may be suffering from disruptions in biological rhythmicity and a specialist can provide much better support. Still, there are a large number of individuals who would benefit from simply improving the conditions of their rest as outlined in Table 14-4. There is some evidence, although not by any means overwhelming, that sleep can be banked to a certain degree. An individual who gets more than enough sleep for a few days will likely handle an acute sleep deprivation episode better than one who is only properly rested. There is much more research that needs to be done on the effects of sleep duration, napping strategies and fatigue counter-measures.

CIRCADIAN DISRUPTION

Crews often disrupt their normal circadian cyclicity by working at night or traveling across multiple time zones. The shiftworker and the air crew face regular episodes of acute circadian disruption. The best remedy is to get back to a normal routine day and night as quickly as possible.

Transmeridian Travel

The typical guidance given is to provide a 24 hour recovery period for each time zone traveled. This is a very conservative estimate. It is more practical and still reasonable to assume that 6 hours of recovery per time zone is adequate. For most individuals, going eastward is more difficult than going westward; that is phase advances of the circadian timing system are more difficult than phase delays. In general, it is better to attempt to get in synchrony with local time if the traveler will be more than 3 days at the new destination. This means eating meals when the locals do and setting your watch and planning for events when the locals do. If the traveler will be less than 3 days at the new destination, it is easier to remain on home time, thereby avoiding the extra days once back at home resynchronizing from the trip. This is accomplished by keeping your watch on home time and, as much as possible, eating meals and sleeping when you would at home. In either case, a Long Nap, not a Normal Sleep, as described above, would be beneficial to the traveler upon arrival at the new destination.

Shiftwork

Most shiftworkers are on a very rapid schedule that is designed to maintain normal circadian rhythmicity by preventing adaptation to any one shift. This puts the responsibility on the crew to schedule their own sleep during unusual times of days on occasion. It is advisable to

get a Long Nap as explained above after the midnight shift, to help maintain that rhythmicity. Sleeping 8 hours after the midnight shift during the day can alter the normal circadian pattern which is advantageous to maintain. Therefore a Long Nap immediately after the midnight shift and immediately before the next midnight shift should make it easier for most individuals to stay on a normal cycle. Of course, most shiftworkers have developed coping strategies that work for them and altering these should only be considered if they violate the sleep hygiene principles or otherwise seem to be dysfunctional for efficient sleep.

Crew Rest

Adequate crew rest is normally 7-8 hours of uninterrupted sleep which utilizes the sleep hygiene principles. It is important to distinguish between the officially designated crew rest times and the actual amount of sleep the crew gets. Often times these can be quite different. Assigned crew rest times are often more advantageous to the schedulers than to the crews. For example, a crew rest period of 24 hours sounds appealing and perhaps is of sufficient duration. However, it usually takes about 12 hours for a sufficient crew sleep period to be accomplished; 2 hours before and 2 hours after an 8 hour sleep period. That leaves about 8-12 hours of peak vigilance for the crew before they should begin feeling tired enough to sleep again. With a 24 hour crew rest period though, a crew that is just getting tired again and ready for another sleep phase would be required to start their duty day. It is often better for the crews to request a 16 hour crew rest period or, ideally, a 36 hour crew rest period. With a 16 hour crew rest, the crew starts their day soon after a sufficiently long sleep and should be performing at peak for several hours. Napping strategies outlined above might be recommended to the crews during periods of acute fatigue, such as those that always accompany the 0200-0600 biological rhythm performance nadir. A 36 hour crew rest is best for crew fatigue recovery because it provides 2 sleep periods and starts the crew duty day soon after the last sleep.

TABLE 14-2. SLEEP HYGIENE TECHNIQUES.

Get rid of sleep debt (allow 8-10 hours of sleep for a few days before a long mission or period of nighttime vigilance)

** Avoid excessive alcohol (a blood alcohol of more than the legal limit before you go to bed can cause profound insomnia; Drink water before bed but not so much that you will have to get up later to urinate).

** Avoid large meals before you go to bed (leave about 6 hours before sleep for digestion).

** Sleep as comfortably as possible in a quiet and as dark as possible environment.

** Don't prop the pillows up to high if you sleep on your back as this can block the airways when REM atonia occurs.

** Personal hygiene helps sleep. Brush your teeth and shower and dress comfortably for sleep and after awakening.

** Avoid caffeinated beverages 3-4 hours before bed. You might not think that it hurts your sleep but it will cause a restless sleep.

** Use Short Nap (< 30 minutes) or Long Nap (3-4 hours) strategies outlined in the text.

** Avoid strenuous exercise about 3-4 hours before bed.

** Get to bed at the same time each night as closely as possible. Consistency in sleep habits (time, procedures) is very important to maintaining biological cyclicity.

** Try deep breathing and muscle relaxation techniques to help with stress reduction and sleep onset.

TABLE 14-3.

SUGGESTED READINGS
CIRCADIAN ASPECTS OF HUMAN PERFORMANCE

Campell, J. Winston Churchill's afternoon nap: a wide-awake inquiry into the human nature of time, S&S Publications, 1987, ISBN: 0-671-47547-9.

Coleman, R.M., Wide awake at 3:00 am, W.H. Freeman and Company, New York, 1986.

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Landes, D.S., Revolution in time: Clocks & the Making of the Modern World, Harvard U. Press, 1985, ISBN: 0-674-76802-7.

Moore-Ede, M.C., Sulzman, F.M. and Fuller, C.A., The clocks that time us, Harvard University Press, Cambridge, Massachusetts and London, England, 1982.

Moore-Ede, M.C. The twenty-four hour society. Addison Wesley Publishing Co. Reading, Massachusetts, 1993.

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HEALTH PROMOTION/ INTERVENTION PROGRAMS

The focus of the Health Promotion Program in the Air Force is to promote healthy lifestyles. We know that optimal health and total fitness are force multipliers. Focused programs in the areas of tobacco cessation, nutrition, fitness, stress management, drug and alcohol abuse prevention, and cancer and cardiovascular disease prevention are offered to increase awareness, educate, intervene, and facilitate healthy lifestyle behavior changes. By reducing health risks, studies have demonstrated reduced absenteeism and decreased health care costs.(68) In a military environment, this equates to increased readiness.

Health and Wellness Centers (HAWCs) are being established to provide "one stop shopping" for fitness and health assessments and health promotion/disease prevention education programs. The HAWC is staffed by health and fitness professionals who provide fitness assessments, exercise prescriptions, health education, counseling and referrals. Individuals are assessed for stage of change and appropriate interventions are made. Through individual or provider referrals, needs assessments, health risk appraisals, utilization management data and case management, at risk individuals and populations are identified for lifestyle changes. Programs are developed to meet the identified needs and evaluated for effectiveness.

Health Promotion services are not limited to the HAWC; outreach to worksites is an equally important service. Health Promotion is involved in many other initiatives including medical self-care, health risk appraisals, Put Prevention Into Practice campaign, and building healthier communities. Health Promotion is teamed with other medical and community based agencies whose goal is to promote the health, safety and morale of AF people.

The Installation Chief, Aerospace Medicine oversees the installation Health Promotion Program as described in AFI 40-101, Health Promotion Program.(7) The prioritized objectives of the DoD Year 2000 Health Objectives are shown in table 14-4.

TABLE 14-4. THE COORDINATED CARE PROGRAM GUIDANCE HEALTH PROMOTION AND DISEASE PREVENTION PROMOTING HEALTH 2000 45 PRIORITIZED OBJECTIVES (1995)

1. Reduce overweight, as measured by Body Mass Index (BMI) kg/m2 to a prevalence of no more than 20% among people aged 20 years and older and no more than 15% among adolescent ages 12-19.

2. Increase to at least 20% the proportion of people aged 18 years or older and to at least 75% the proportion of children and adolescents aged 6-17 who engage in vigorous physical activity that

promotes the development and maintenance of cardiorespiratory fitness three or more days per week for 20 or more minutes per occasion.

3. Reduce cigarette smoking to a prevalence of no more than 20% among military personnel, and to no more than 15% among those aged 20 years and older.

4. Reduce smokeless tobacco use by males aged 12-24 years to a prevalence of no more than 4%.

5. Reduce the proportion of high school seniors and college students engaging in recent occasions of heavy drinking of alcoholic beverages to no more than 28% of high school seniors and 32% of college students.

6. Reduce nonfatal unintentional injuries that require hospitalization to no more than 754 per 100,000 people.

7. Increase the use of occupant protection systems, such as safety belts, inflatable safety restraints, and child safety seats, to at least 85% of motor vehicle occupants.

8. Increase use of helmets to at least 80% of motorcyclists and at least 50% of bicyclists.

9. Increase to at least 45% the proportion of people ages 35-44 who have never lost a permanent tooth due to dental caries or periodontal diseases.

10. Increase abstinence from tobacco use by pregnant women to at least 90% and increase abstinence from alcohol, cocaine and marijuana by pregnant women by at least 20 percent.

11. Increase to at least 90% the proportion of people with high blood pressure who are taking action to help control their blood pressure.

12. Increase to at least 90% the proportion of adults who have had their blood pressure measured within the preceding two years and can state whether their blood pressure was normal or high.

13. Increase to at least 75% the proportion of adults who have had their blood cholesterol checked within the preceding five years.

14. Increase to at least 80% the proportion of women aged 40 years and older who have ever received a clinical breast examination and a mammogram; and to at least 60% those aged 50 years and older who have received them within the preceding one to two years.

15. Increase to at least 95% the proportion of women aged 18 years and older with an intact uterine cervix who have ever received a Pap test, and to at least 85% those who received a Pap test within the preceding one to three years.

16. Increase to more than 50% the proportion of sexually active, unmarried people who used a condom at last sexual intercourse.

17. Reduce gonorrhea to an incidence of no more than 225 cases per 100,000 people.

18. Increase to at least 95% the proportion of people who have a specific source of ongoing primary care for coordination of their preventive and episodic health care.

19. Reduce deaths caused by alcohol-related motor vehicle crashes to no more than 85 per 100,000 people.

20. Extend to all DoD facilities, legal blood alcohol concentration tolerance levels of .04% for motor vehicle drivers aged 21 years and older and .00% for those younger than age 21.

21. Reduce suicides among males aged 20-34 years to no more than 21.4 per 100,000.

22. Reduce to less than 25.2 per 1,000 children, the incidence of maltreatment of children younger than age 18 years.

23. Reduce physical abuse directed at women by male partners to less than 27 per 1,000 couples.

24. Reduce deaths caused by motor vehicle crashes to no more than 16.8 per 100,000 people.

25. Reduce deaths from work-related injuries to no more than four per 100,000 full-time workers.

26. Reduce work-related injuries resulting in medical treatment, lost time from work, or restricted work activity to no more than 6 cases per 100 full-time workers per year.

27. Increase hepatitis B immunization levels to 90% among occupation exposed workers.

28. Reduce low birth weight to an incidence of no more than 5% of live births and very low birth weight to no more than 1% of live births.

29. Increase to at least 90% the proportion of DoD food service operations that offer identifiable low-fat, low calorie food choices, consistent with the Dietary Guidelines for Americans.

30. Increase to at least 75% the proportion of DoD worksites with a formal smoking policy that prohibits or severely restricts smoking at the workplace.

31. Increase to at least 75% the proportion of primary care and oral health care providers who routinely advise cessation and provide assistance and follow-up for all of their tobacco using patients.

32. Extend adoption of alcohol and drug policies for the work environment to 100% of DoD worksites.

33. Extend to all DoD facilities, driving privilege suspension\ revocation laws or programs of equal effectiveness for people determined to have been driving under the influence of intoxicants.

34. Increase to at least 60% the proportion of primary care providers who provide age-appropriate preconception care and counseling.

35. Reduce severe complications of pregnancy to no more than 15 per 100 deliveries.

36. Reduce the mean serum cholesterol level among adults to no more than 200 mg/dl.

37. Reduce breast cancer deaths to no more than 20.6 per 100,000 women.

38. Reduce significant hearing impairment to a prevalence of no more than 82 per 1,000 people.

39. Increase to at least 85% the proportion of DoD worksites that offer health promotion activities for their employees, preferably as part of a comprehensive employee health promotion program.

40. Extend the requirement of the use of effective head, face, eye, and mouth protection to all DoD sponsored sporting and recreation events that pose risks of injury.

41. Implement occupational safety and health plans to all DoD activities for the identification, management, and prevention of leading work-related diseases and injuries with the activity.

42. Increase to 100% the proportion of DoD worksites that offer back injury prevention and rehabilitation programs.

43. Increase to at least 75% the proportion of primary care providers who routinely counsel patients about tobacco use cessation, diet modification, and cancer screening recommendations.

44. Increase to at least 50% the proportion of people who have received, as a minimum within the appropriate interval, all of the screening and immunization services and at least one of the counseling services appropriate for their age and sex as recommended by the US Preventive Services Task Force.

45. Identify and create where necessary, DoD data sources to measure progress toward each of the DoD Year 2000 Health Objectives.

CLINICAL PREVENTIVE MEDICINE

The identification of health risks specific to a population and/or age group is critical to both the prevention and early clinical intervention of disease. Increasingly, patients and medical delivery organizations seek preventive care services to increase health and decrease medical care costs. In the military, preventive medicine primarily seeks to optimize the health of individual members and preserve the fighting strength of trained forces. An additional benefit of clinical preventive medicine may be cost reductions in health care and military training (due to increased retention of military members).

The USAF Medical Service is increasing its investment in clinical prevention medicine through the introduction of **Put Prevention Into Practice (PPIP)**. This program was initially developed by the US Public Health Service, Office of Disease Prevention and Health Promotion. PPIP provides protocols for the identifying needs and providing preventive services. Tools for office management include training for office staff and new medical record overprints charting needed and accomplished interventions. Particularly useful, PPIP provides scientific analysis of screening examinations based on positive predictive value, effectiveness of early intervention and cost of exam and treatment. The reader is referred to The Clinician's Handbook of Preventive Services, reference 91, for further reading about PPIP. Described below are common health problems in the military population, along with some of their clinical interventions.

OBESITY

The Problem

Obesity has been defined (by an NIH Consensus Panel) as weighing more than 120 percent of ideal body weight (IBW). (55) It is estimated that 30-50 percent of the total American population is obese. The greater the excess weight, the greater the risk of death from cardiovascular disease, diabetes, cholelithiasis, renal diseases, respiratory diseases, and cancer. Fat deposition around the waist and upper abdomen (versus other areas of the body) is most associated with increased risk of disease. (60,48)

Weight Control and the Flier

Obesity in the young flier may be a relatively insignificant immediate hazard to effective flying, but the flight surgeon should be concerned with the role of excess fat in disease. The young flier has completed a phase of life during which physical activity, growth, maturation, and metabolism have allowed the consumption of a high calorie diet with little concern for excess weight gain. Prior regimens of physical training and activity might be replaced by long hours of inactive alert, regular flights, and periods without physical training. Continuation of previous diet habits with this inactivity results in a positive caloric balance and difficulty in maintaining weight control. (28)

Obesity can produce disabilities for a flier by the sheer physical handicaps of a high body weight and increased dimensions. Working conditions in cramped cockpits may be affected as well as the fit of specialized personal equipment. The ability to react with agility in emergency situations may also be affected. There is also some evidence that obesity increases the risk of aviation decompression sickness due to the high solubility of nitrogen in fatty tissues. (23)

Air Force Weight Program

AFI 40-502 requires that body weight be maintained within a prescribed range relative to height (AFVA 40-503, USAF Maximum Allowable Weight Table) or percentage of adiposity (body fat measurement using nomogram in PC III). The reader is referred to AFI 40-502 for administrative guidance.

Maximum Allowable Weight. The tables in AFVA 40-503 do not reflect individuals' desired weight but rather their "maximum allowable weight" (MAW). Desired weight is the weight at which a person should have the best life expectancy. Desired body weight is usually determined individually depending upon the person's bone structure and muscle mass. As a rule of thumb, 10 percent below individual's MAW for height more closely approximates his or her desired weight as calculated by the accepted height and weight charts. (1)

Determination of IBW. The rule of 5's and 6's may be used to determine the ideal body weight (IBW) for median-framed adults, age 18 and older. See figure 14-1, *Nomogram for Body Fat Measurement (BFM)*. The nomogram in PC III can be used by the unit commander to determine BFM and then make a weight adjustment if necessary. This nomogram was derived from a nomogram developed to predict lean body mass from anthropometric measurements: for men it is the circumference of the waist minus the neck, and for women it is the circumference of the hips plus the waist minus the neck. The reader is referred to references 29 and 30 for further discussion of this nomogram's derivation.

Determination of Caloric Needs

In general, a person's daily caloric need is calculated by adding the basal amount to the amount needed for daily activity. See figure 14-2.

One pound of body fat represents 3,500 Kcals. To lose one pound per week requires a caloric deficit of 500 Kcals/day; two pounds per week requires a deficit of 1,000 Kcals/day.

Example: A 6 foot tall sedentary man who wishes to lose 2 lb/week must reduce his caloric intake to 1,314 Kcal/day or reduce his caloric intake to 1,814 Kcals/day (a 500 Kcal deficit) and burn up 500 Kcals each day through exercise.

Rule of 5's and 6's (used for medium-framed adults, age 18 and older)

A. Men: 106 for first 5 ft. + 6 lb. for each inch over 5 ft.
Example: Man 6 ft. tall = 106 lb. + (6x12) = 178 lb.

B. Women: 100 lb. for first 5 ft. + 5 lb. for each inch over 5 ft.
Example: Woman 5'4" tall = 100 lb. + (5x4) = 120 lb.

C. Because of variations in body frame size, the ideal weight is not considered to be a precise figure. Instead, it is given as a range, with a 10 percent leeway on either side of it to cover small and large-boned individuals. Therefore, in the examples above, the ideal weight ranges would be given as:

178 lb. ± 10% (160-196 lb.)

120 lb. ± 10% (108-132 lb.)

A person falling within 10 percent of their IBW as calculated using the Rule of 5's and 6's is said to be within their ideal weight range.

Figure 14-1. Determination of Ideal Body Weight (IBW)

Determining Caloric Needs

I. ***Basal Needs*** (calories needed daily by the body to perform basic metabolic processes, without movement or activity)

= IBW in lb. x 10 Kcals/lb.
= calories/day needed to meet basal requirements

II. ***Voluntary Energy Expenditure***

= IBW in lb. x 13 (sedentary activity, e.g. - most of us)
x 15 (moderate)
x 20 (vigorous)

Example: 6 ft. man who is fairly sedentary (e.g., does a small to moderate amount of walking in his job, plays golf a few times a week, maybe plays tennis on the weekend)

IBW (178 lb.) x 13 = 2,314

Figure 14-2. Determination of Caloric Needs for **Weight Loss**

Weight Loss Diets and Flying Safety

Flight surgeons should recommend that aircrew follow no less than a 1,200 Kcal/day diet coupled with exercise for controlled weight loss and continued safe and effective weight control. (48) A consult to the dietitian may be appropriate. Weight loss diets and methods are described in many references: AFPAM 44-125, Good Eating: A Dieter's Guide; AFPAM 44-132, Dietary Information for Weight Loss; AFP 166-26, Improving Eating Habits, and USDAHGB 232, Dietary Guidelines for Americans (HGB #232). (12, 13, 17, 18)

Aircrew members attempting to lose weight may be attracted to fad diets which promise accelerated weight loss. Such diets are often very low calorie diets (less than 600 Kcal/day) or involve herbal preparations, both of which may be hazardous for the aircrew member. Although the current "balanced nutrition" very low calorie diets have proven to be much safer than the liquid-protein diets of the mid-1970s, they are not free of significant side effects. Aircrew members on such diets may experience nausea, diarrhea, headache, fatigue, irritability, cold intolerance, light-headedness, nervousness, euphoria, anemia, and mild depression.(56) None of these diets are totally protein sparing and their use will result in loss of lean body mass. Although less common, myocardial damage and cardiac dysrhythmias may occur. (42)

Herbal preparations, although considered food items, may in fact contain potent pharmaceutical agents. Currently marketed preparations contain active diuretics, laxatives and even cardiac glycosides (including foxglove). Some have ingredients with anti-cholinergic activity and sedative/hypnotic properties. The Food and Drug Administration (FDA) has documented adverse reactions to these products and condemned a few ingredients as unsafe for food use. (42)

Flight surgeons should warn aircrew members of the hazards of very low calorie diets or herbal products and encourage them to seek flight surgeon approval for any weight loss regimen prior to use. The reader is referred to references 40 and 57 for further discussion of food faddism.

SMOKING

The Problem

Tobacco smoking is the number one cause of reversible morbidity and mortality in the United States.(53) Tobacco use is related to 400,000 deaths annually in the United States. (67) A person who smokes one pack a day has an average life expectancy 5 years less than a non-smoker, and a two pack a day smoker, 7 years less.

Smoking is responsible for 30 percent of all cancers in the general population and 90 percent of lung cancers in men and 79 percent among women. (65). It also increases the risk of death from cardiovascular disease (3 times as many deaths as from lung cancer). See section on cardiovascular disease in this chapter. There is also an increased risk of emphysema and bronchitis. (53)

There are three significant components of tobacco smoke from a health and performance standpoint:

Tar, which has been demonstrated to cause cancer.

Nicotine, which is associated with cardiovascular health and has an effect on performance.

Carbon monoxide, which is a toxic gas created by incomplete burning of any organic matter in the cigarette and is also associated with cardiovascular disease. The presence of carbon monoxide also reduces oxygen distribution to the brain and body and affects performance. (32)

Smoking and the Flier

Among fliers, irritated mucous membranes further aggravated by long periods of breathing dry 100 percent oxygen can result in more restricted breathing capacities and severe bronchial coughing. There is always the fire hazard of cigarette smoking in cockpits in the presence of oxygen sources. Carbon monoxide interferes with oxygen transportation and delivery to tissues and thus produces a hypoxic and stagnant hypoxia. This may cause a significant reduction in night vision and be additive to the hypoxia resulting from decreased barometric pressure. (28)

Quitting

Within 24 hours of abrupt smoking cessation, any of these symptoms may occur: craving for tobacco, irritability, anxiety, difficulty concentrating, restlessness, headache, drowsiness, and gastro-intestinal disturbance. Most run their course in 1 to 2 weeks. Psychological withdrawal symptoms last longer.

Most of the drugs which have been used for reduction of cigarette smoking are unsatisfactory for fliers because their use requires temporary suspension from flying. Currently the nicotine patch or nicotine gum preparations may be used by fliers if the use is coordinated with a flight surgeon and adequate ground testing has occurred. Smoking cessation programs should be established and stressed. Most MTFs require anyone using the nicotine patch to be enrolled in a smoking cessation program, and flight surgeons should encourage flying personnel to enroll in such programs.

STRESS

Stress can result from any change that one must adapt to. Whether the stress is minor or serious, positive or negative, it always produces certain physiological changes in the body. If the stress is consistent or severe, these changes may produce any of a host of health problems, e.g., headaches, muscle tension, anxiety, depression, lowered body resistance to infections, and increased use or dependence on medication, drugs, or alcohol. The flier is not immune to any of these.

Homes and Rahe (35) related stress to illness by tying stress in life to adjustment to the onset of illness. The Social Readjustment Rating Scale consists of 43 life events to which values can be applied in order for one to predict the probability of illness within 2 years. This scale is reproduced in AFP 50-45, which also gives some hints on how to handle daily stress.

The flight surgeon should know the fliers' personalities and their families. Flight surgeons should work closely with the flight commanders and squadron commanders to learn when a flier is too stressed. This Life Events and Health Risk Scale can be used as a general tool to raise a warning flag of too much stress. *(Editor's note: Remember also that moderate amounts of stress will boost performance, and that the only time people are without stress is when they are dead!).*

CORONARY ARTERY DISEASE

Risk Factors

Numerous epidemiological studies have identified certain risk factors which identify individuals who are more likely to develop premature cardiovascular disease. These factors are listed in Table 14-1. Of those that can be changed by making a change in lifestyle, serum cholesterol, LDL cholesterol, HDL cholesterol, exercise, smoking, stress, personality, and obesity will be discussed. The presence of multiple risk factors in an individual has a synergistic effect on total risk. The total risk from multiple risk factors tends to be multiplicative rather than additive. (53) (37)

TABLE 14-5. RISK FACTORS FOR CARDIOVASCULAR DISEASE

Age
Male>45y
Female>55y or premature menopause without estrogen replacement therapy
Serum Cholesterol(>200 mg/dl)
Abnormal ETT
Hypertension (blood pressure >140/90 mmHg, or taking antihypertensive medication)
Diabetes mellitus
Low HDL Chol(<35 mg/dl)
Abnormal EKG
Family Hx of premature CHD (definite myocardial infarction or sudden death before 55 y of age in father or other first-degree relative, or before 65 y of age in mother or other female first-degree relative)
Cardiomegaly
Inactivity
Stress
Personality
Current cigarette smoking

NEGATIVE RISK FACTOR: High HDL cholesterol (>60 mg/dl)

Cholesterol is a major component of the atherosclerotic plaque. Elevated serum cholesterol levels (above 185 mg percent) have been independently associated with increasing risk for the development of cardiovascular disease. The higher the cholesterol level the greater the risk of developing cardiovascular disease. The Framingham study demonstrates that the increase in risk for an individual with a serum cholesterol of 185 mg percent can be as high as 4.0 with all other risk factors being equal. (37) The importance of cholesterol as a risk factor disappears after age 55, but LDL/HDL remain strongly predictive. (31)

The Japanese have the lowest prevalence of coronary artery disease in the "developed" world and have serum cholesterol levels that are only 60 percent as high as those living in the United States. The Japanese diet contains far less cholesterol and saturated fat than the average diet in the United States. When the Japanese move to the United States, their serum cholesterol levels rise. They subsequently develop an increase in their mortality from coronary artery disease. (59)

"Normal" levels of serum cholesterol in the United States are much higher than the "normal" levels of serum cholesterol in Japan. It is also "normal" to have a heart attack at a relatively early age in the United States. The elevated levels of serum cholesterol and LDL observed in the United States are probably responsible for the high percentage of atherosclerotic plaques seen in the young victims of the Korean and Vietnam conflicts, as well as the children who died from trauma in the Bogalusa Heart Study and inversely related to the ratio of HDL Cholesterol/LDL Cholesterol and VLDL cholesterol.. (61)

Lowering serum cholesterol by diet, or diet plus cholesterol lowering medications has been demonstrated in several studies to reduce cardiovascular catastrophes. Further, individuals have had regression of "fixed" atherosclerotic lesions when their serum cholesterol levels have been lowered with diet, or diet and medications. High serum cholesterol levels are associated with atherosclerotic obstruction of the grafts in individuals who have received coronary artery bypass surgery.

Although each individual study on the benefits of cholesterol lowering has been criticized, the data, when viewed in aggregate, is overwhelmingly in support of the importance of lipid reduction.

The ideal cardiac diet is low in cholesterol, 30% of Kcalorie intake from total fat and 7-10% of Kcalorie intake from saturated fat, containing a balance of polyunsaturated and monounsaturated fat, high in fiber, low in simple sugars, low in sodium and contains only enough calories to maintain ideal body weight. (54)

High Density Lipoprotein (HDL) Cholesterol

Serum levels of high density lipoprotein (HDL) cholesterol correlate inversely with the development of cardiovascular disease and levels greater than 60 mg/dl are associated with low rates of cardiovascular diseases. It has been proposed that the serum HDL cholesterol level reflects the rate of removal of cholesterol deposits from the vascular tree. (54) Diet, exercise and

smoking affect the serum HDL levels. Inactivity, obesity and smoking decrease the HDLs as well as a very low fat diet.(62) The National Cholesterol Education program recommends a fat intake of 30% or less. (63) It also states that, for persons who are not willing to decrease their fat intake that much, a 30-35% calories from fat of mostly monounsaturated sources is effective. (63) A very low fat (20% calories from fat) diet will decrease serum HDL levels. (62) "Available evidence shows that for every 1 mg/dl decrease in HDL cholesterol, the risk for CHD is increased by 2% to 3%." (63)

From a clinical and epidemiologic standpoint the ratio of total cholesterol (TC) to HDL cholesterol (TC/HDL) is far more predictive for the presence of coronary artery disease (CAD) or its progression (when assessed through serial coronary angiographs) than is any other single risk factor. (51) (20) Significant coronary artery disease as shown on cardiac catheterization has been found in 85 percent of the asymptomatic aviators, over age 40 when the ratio of total cholesterol to HDL cholesterol was 6.0 or higher.(51) These aviators had been initially referred to the United States Air Force School of Aerospace Medicine (USAFSAM) for evaluation if they had an abnormal exercise tolerance test or a change in their resting EKG.

A retrospective analysis of all aviators referred for cardiac evaluations at USAFSAM resulted in the development of the SAM Risk Index. The Risk Index = Age x Age (TC/HDL - 1) and is used to "predict" the presence of significant CAD. The Risk Index does not include any of the other traditional risk factors. However, many of them have important effects on the ratio TC/HDL. For example, smoking lowers HDL cholesterol and increases the Risk Index. Table 14-2 shows that many risk factors are hidden in the Risk Index because of their effect on total cholesterol, HDL cholesterol, or both.

TABLE 14-6. EFFECT OF RISK FACTORS ON TOTAL CHOLESTEROL, HDL CHOLESTEROL AND THE TC/HDL RATIO.

Risk Factor	Chol	HDL Chol	TC/HDL
Weight Gain	+	-	+
Diabetes	+	-	+
Moderate Alcohol	N/C	+	-
Heavy Alcohol	+	-	+
Inactivity	+	-	+
Smoking	N/C	-	+
Triglycerides	+/-	-	+
Hypertension	N/C	N/C	N/C

Blood pressure is an important risk factor but has no direct effect on serum lipids. In the Air Force active duty population, undiagnosed, untreated, or uncontrolled hypertension is extremely rare. For this reason blood pressure did not seem to be a predictor for CAD. In populations where blood pressure is not as well controlled, the inclusion in a predictive formula would probably enhance formula accuracy. (34) (53)

In summary, individuals with low serum HDL levels, or a high total cholesterol HDL ratio, are at increased risk of CAD. Most of the therapeutic modalities which effect traditional risk factors will improve the total cholesterol HDL ratio. Risk modification methods include aerobic exercise, moderate use of alcohol, weight loss, smoking cessation, consumption of low cholesterol, fat controlled diet, reduction in dietary sugar, and pharmacological intervention if needed. (53)

Exercise

A number of epidemiological studies have shown an inverse relationship between physical activity and the prevalence of coronary heart disease. (53) Some researchers believe that the protective effect of exercise begins at the 1,500 Kcal of energy expenditure per week, with a maximal effect at the 2,000 Kcal level. (Approximately 100 Kcal are used to run 1 mile) (39). However, not all epidemiologic studies show a dose dependent protective role of physical activity against CAD.

Poor physical fitness is an important risk factor for all-cause mortality in men and women. Higher levels of physical fitness appears to delay all-cause mortality primarily due to decreased rates of cardiovascular disease and cancer. (66) Sedentary lifestyle, when combined with poor diet, is responsible for 300,000 deaths each year in the United States. (67) The protective effect of exercise against coronary artery disease has been shown to be effective in reducing risk factors for coronary heart disease. (69)

Several findings suggest mechanisms for the protective effect of exercise against CAD. An inverse relationship has been shown to exist between aerobic capacity and relative weight. (39) Aerobic exercise reduces blood pressure in individuals with mild hypertension and is known to increase serum HDL cholesterol. (53) These affects are over and above the benefits to the cardiovascular physiology (lowered pulse rate, increase in maximal oxygen uptake and transport, and a decrease in resting cardiac oxygen requirements and coronary blood flow). Finally, animal studies have shown that exercise increases the size of the coronary arterial tree as well as the myocardial capillary density. (39)

For inactivity, risk modification includes an exercise program in which aerobic exercise is preferred over anaerobic. For specifics, see the physical fitness section.

Smoking

Smoking increases the concentration of both nicotine and carboxyhemoglobin in the blood in a dose dependent manner. Both have markedly adverse effects on the cardiovascular system and predispose one to sudden death. Increasing tobacco consumption is associated with increasing risk of cardiovascular disease. Smoking one half package of cigarettes per day will

increase the likelihood of CAD by 3.1 fold, one pack per day by 3.9 fold, and 2 packs per day by 6.63 fold. Smoking also increases the risk of stroke by 50 percent. (53)

Smoking accelerates the development of CAD by four possible methods: a.) it lowers serum HDL cholesterol, b.) causes spasm of the coronary arteries, c.) increases serum fibrinogen (an independent risk factor for cardiovascular disease) which increases tendency to thrombosis and acute myocardial infarction, and d.) increases the carbon monoxide levels of the blood which reduces the oxygen carrying capacity of blood and predisposes to angina.

Risk modification methods include patient education, encouragement to quit, and formal smoking cessation programs.

Obesity

Obesity is an independent risk factor for development of cardiovascular disease. Excess weight is associated with a number of other CAD risk factors; diabetes mellitus, hypertension, hypercholesterolemia, hypertriglyceridemia, hyperglycemia, and low serum HDL cholesterol levels. (54) Weight loss is associated with beneficial changes in many risk factors. These changes include a decrease in total serum cholesterol and LDL cholesterol, a decrease in serum triglyceride, elevation of serum HDL cholesterol levels, and a decrease in both systolic and diastolic blood pressures in hypertensive individuals. Many individuals will experience a transient weight loss but an improvement in the total cholesterol HDL ratio. (53)

Serum Triglycerides

Many epidemiological studies have demonstrated that elevated serum triglycerides are associated with an increased risk for the development of cardiovascular disease. (53) A review of the literature (53) noted that elevated serum triglyceride levels are frequently associated with elevated serum cholesterol, diabetes mellitus, obesity, and low serum HDL cholesterol levels. When multivariate analysis is performed with these other risk factors, hypertriglyceridemia does not appear to be an independent risk factor for cardiovascular disease.

The primary modes of therapy for hypertriglyceridemia include weight control, increased physical activity, alcohol restriction, and in some cases, restriction in dietary fat and concentrated carbohydrates.(54)

Behavioral Risk Factors

In most studies undertaken and published, a positive association was demonstrated between CAD and one or more of the following: anxiety, depression, neuroticism, somaticization, and type A personality. However, there is less agreement and reproducibility between these studies than there is with the studies on the physical risk factors such as smoking, serum cholesterol, and hypertension. (53) (36)

At least 13 studies have demonstrated a positive correlation between CAD and type A personality. (36) Type A personality is characterized by competitiveness, intense striving for achievement, easily provoked, hostility, impatience, and concentration on self-selected goals. Type B personality is the opposite of Type A in which the person is more relaxed, unhurried, and

less easily provoked. However, the recent Multiple Risk Factor Intervention Trial (47) found no correlation between personality Types A and B and CAD.

The conclusion on whether behavioral risk factors are independent for the development of CAD is in part secondary to lack of adjustment for all known risk factors in most studies. The "coronary prone" behavior may in actuality reflect the products of an inactive life style, i.e., overweight, low serum HDL levels, inactivity. Data analyses would need to consider these factors. (53)

Finally, there is a paucity of evidence that changing these factors prevents CAD. To date no study has demonstrated convincingly that changing one's personality from Type A to Type B improves cardiovascular risk. (53)

The behavioral risk factors associated with future chances of disease and/or injury include: current smoker, rarely or never exercise, sometimes or frequent use of medication or drugs, more than 14 alcoholic drinks a week, rarely use safety belts, only somewhat or not very satisfied with life, dissatisfied or very dissatisfied with the job, rate physical health as “fair” or “poor”, absent more than five days a year for illness, systolic blood pressure above 140 mm Hg, diastolic blood pressure above 90 mm Hg, cholesterol of 240 mg/dl or more, more than 20 percent overweight, and under high stress. The presence of multiple risk factors have been related to both increased absenteeism and health care costs. (68)

Offering or referring individuals to lifestyle behavior change programs can be an effective means of facilitating behavioral change and reducing health risks; thus improving the health status of the individual and the unit. Programs need to provide activities to reduce high risk behaviors and provide activities for low-risk individuals in order to maintain their low risk status.

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ATTACHMENT I

HIGH INTENSITY MUSCULAR CONDITIONING

Introduction

A sound resistance training program for fighter aircrews consists of two specific workouts: a. ***strength and power***, and b. ***endurance***. This resistance training program is designed to get you into shape during the first 12 weeks and then keep you in shape thereafter. The initial 12-week program ideally should be performed on a 4-day a week basis. Monday and Thursday for strength and power, Tuesday and Friday for endurance, and Wednesday, Saturday and Sunday for rest. Each workout is described in the following sections. It is important that rest periods are strictly adhered to, exercise sequences within the workout segments are followed, and repetition maximum loads are used (weight allows only the number of repetitions listed to be performed).

Strength and Power Workout

The strength and power conditioning session should begin with a short period (5-10 minutes(min)) of warm-up and stretching. Mild calisthenic activity, slow jogging in place or brisk walking is suggested. Rest periods should occur between sets and between exercises; i.e., between each series of a given exercise, as well as between specific exercises. Rest periods should be between 2-3 min and at least equal to the amount of time spent in performing the set. The resistance for each exercise is the load which can be achieved for the indicated number of repetitions, called "repetition maximum" (RM) load. For example, if one can curl 100 pound (lb) for 10 repetitions but no more, the exercise is a 10 RM movement. When one or more repetitions beyond the specified limit can be performed, more weight or resistance should be added. A set refers to the number of repetitions completed for a given exercise. The exercises are listed in the order they should be performed. All sets of a specific exercise should be performed before moving on to the next. Repetitions should be performed in 3-5 seconds(sec). Following the workout, a 5-10 min period of stretching exercises should be done to minimize delayed muscle soreness.

Endurance Resistance Workout

5-10 min warm-up and stretching period similar to that described for the strength conditioning workout should precede each session. Endurance workouts use paired exercises. A set of the first exercise is performed and, without rest, a set of the second exercise is performed. For example, one might perform 10 repetitions of the bench press immediately followed by 10 repetitions of the shoulder shrug. This is known as a super set. A super set is followed by a 30-60 second rest and repeated. Two to 3 super sets per pair of exercises are recommended. The specific order of the exercises within each super set should be maintained. A 5-10 min period of stretching similar to that described for the strength conditioning workout should follow each session.

Stack Machine Weight Equipment

The exercises comprising the muscular strength workout for multi-station weight stack machines are as follows:

***Strength Emphasis Workout*:**
Warm-up: 5-10 min
Rest period: 2 min between sets.

Exercise	Sets/Reps	Figure	Short Version
1. Leg press	4 / 5 @ 5 RM*	14-3	5**
2. Bench press	4 / 5 @ 5 RM	14-4	3
3. Lat pull	3 / 5 @ 5 RM	14-5	4
4. Military press	3 / 8 @ 8 RM	14-6	6
5. Arm curl	3 / 6 @ 6 RM	14-7	7
6. Sit-up	2 / 10-20	14-8	1
Leg raise	2 / 10-15	14-9	
7. Neck series (with self or partner)	3 / 6 @ 6 RM	14-10A-C	2

* RM = repetition maximum level, the amount of weight that can be lifted for only that specific number of repetitions in good form.
** Exercise priority, see text.
Cool-down: 5-10 min.

***Endurance Emphasis Workout*:**
Warm-up: 5-10 min.
Rest period: 30-60 sec between super sets and exercise segments.

Exercise	Sets/Reps	Figure	Short Version
1. Leg extension/leg curl	3 / 10 @ 10 RM	14-11,12	5
2. Bench press/ shoulder shrug	3 / 10 @ 10 RM	14-4,13	3
3. Lat pull/seated row	3 / 10 @ 10 RM	14-5,14	4
4. Military press/ upright row	3 / 10 @ 10 RM	14-6,15	6
5. Arm curl/ tricep extension	3 / 10 @ 10 RM	14-7,16	7
6. Sit-up/leg raise	2 / 10-20	14-8,9	1
7. Neck series (with self or partner)	3 / 12 @ 12 RM	14-10A-C	2

Cool down: 5-10 min.

Free Weight Equipment

The program can be performed using free weight or stack machine weights with minimal modification; e.g., squat for leg press. Some locations will have only free weights. In these situations, the same workout schedule as listed for the stack machine weights should be used. A spotter must always be used in a free weight program. The free weight exercises are listed opposite the equivalent machine weights.

Strength Emphasis Workout

Machine Weights	Free Weights	Figures	Short Version
1. Leg press	Squat	14-3,17	5
2. Bench press	Bench press	14-4,18	3
3. Lat pull	Pull up (arm and	14-5,19	4
	chest pull over)	14-20	4
4. Military press	Military press	14-6,21	6
5. Arm curl	Arm curl	14-7,22	7
6. Sit-up/leg raise	Sit-up/leg raise	14-8,9	1
7. Neck series	Neck series	14-10A-C	2

Endurance Emphasis Workout

Machine Weights	Free Weights	Figures	Short Version
1. Leg extension	Squat	14-11,17	5
Leg curl		14-12	
2. Bench press	Bench press	14-3,18	3
Shoulder shrug	Shoulder shrug	14-13	
3. Lat pull	Pull up (arm and	14-5,19	4
	chest pull over)	14-20	4
4. Military press	Military press	14-6,21	6
Upright row	Upright row	14-15,23	
5. Arm curl	Arm curl	14-7,22	7
Tricep extension	Bar dip	14-16,24	
6. Sit-up/leg raise	Sit-up	14-8	1
Leg raise	Leg raise	14-9	
7. Neck series	Neck series	14-10A-C	2

The weight lifted should be increased when more than the specified number of repetitions in a set can be performed. Recommended increments are 5-10 lb. per exercise.

Hydraulic Equipment

If hydraulic equipment is used, the general conditioning principles listed earlier will apply, but the mechanics will be different. Suggested dial settings for the strength and endurance emphasis workouts are listed. Repetitions should be performed as rapidly as possible.

***Strength Emphasis Workout*:**

Warm-up: 5-10 min.
Perform 4 sets: 1 set at each dial setting of 3, 4, 5, 6.
Work period: 20 sec per set.
Rest period: 2 min between sets.
Cool-down: 5-10 min.

***Endurance Emphasis Workout*:**

Warm-up: 5-10 min.
Perform 4 sets: 1 set at each dial setting of 3, 4, 5, 4.
Work period: 30 sec per set.
Rest period: 30-60 sec between sets.
Cool-down: 5-10 min.

The exercises to be performed are listed in sequence below and depend on equipment available:

Exercise	Figure
1. Knee flexion and extension	14-25
2. Chest press and row	14-26
3. Shoulder press and lat pull	14-27
4. Chest press and row	14-26
5. Abdominal and low back	14-28
6. Neck lateral flexion	14-29
7. Neck extension and flexion	14-30

Maintenance Program

After successful completion of the 12-week program, the program should be continued to maintain gains acquired. To maintain this new fitness level, the recommended schedule should include a minimum of 2-3 workouts evenly distributed over 7 days. These workouts should be a combination of the different programs. The workouts should not be performed on consecutive days and should represent complete workouts of an intensity equal to that performed when the program was completed.

Shortened Program

It is possible to shorten the program yet achieve much of the benefit. A shortened program can be accomplished by either a. reducing the number of different exercises using the recommended numbers of sets or b. performing all of the exercises but completing only 2 sets of each. If the first version is to be used, the exercise order is different from that recommended for the total program (see exercise priorities listed under the short version). This exercise order places emphasis on muscle groups most contributive to enhanced G tolerance.

Program Interruptions

To minimize the effect of interruptions, a minimum of 5 weeks of uninterrupted conditioning should be planned. In this time, sufficient training adaptation will occur to initiate gains in muscular strength and endurance. During interruptions, the participant should continue the training program by whatever means available at least twice weekly. If standard exercise equipment is not available, devote the exercise time to push-ups, sit-ups, leg raises, back arches, neck flexion and extension movements, and isometric contractions of the major muscle groups.

The RM load used for each exercise will decrease during nontraining periods. Consequently, RM load determinations before resuming exercise can be used to select the proper load to restart the program. If the break in conditioning is 2 weeks or more, you should probably return to the program using 80-90 percent of the previous load.

Preflight/Pre-Engagement Warm-Up

Preparation for G stress in air combat should include muscular warm-up. Warm-up not only reduces the risk of injury, but enhances flying performance. The exercises should include those muscle groups that are active in high-G maneuvers. Ideally, warm-up and stretching should begin 30 min before G exposure and taper to 5 min before the actual engagement. Since conditions are seldom ideal to permit this type of warm-up schedule, the minimum recommendations are as follows:

a. While in the Life Support section, perform stretching movements, trunk rotation, and neck rotations in all directions.

b. During walk-around, perform front and back stretching, neck rotation, neck stretching, and deep knee bends.

c. During taxi or in EOR or while waiting for takeoff, perform neck stretching against resistance. This procedure requires neck flexion against the resistance provided to the head by the hand. Care should be taken to avoid applying too much resistance as it could be painful or cause muscle strain.

d. Once airborne, perform several moderately intense anti-G straining maneuver (AGSM) and several maximal neck stretches during G-awareness turns or tactical turns.

Suggested Aerobic Program

While several exercises can be performed to produce aerobic conditioning, running is the most common. A running program of 20-30 min, three times per week is adequate for maintaining good cardiovascular fitness while avoiding the possible adverse effects of excessive

aerobic training. For aircrew who desire to run more, the maximum program suggested is 3-5 miles a day, no more than four times a week. If more than 9 miles a week, the running must be integrated with the recommended weight training program to achieve optimal results. Persons unaccustomed to aerobic conditioning should begin the program by initially running short distances at a slow pace. The time and distance of running should then progressively be increased until the appropriate level of conditioning is attained.

Alternatives to Running

Racquetball, cycling, swimming, cross-country skiing, aerobic exercise, etc., are also classified as aerobic exercises. These activities should be performed at an intensity that will achieve the targeted heart rate for a minimum of 20 min. For lower intensity exercise, such as brisk walking, a longer duration may be necessary. For example, a 20-year old might only achieve a heart rate of 110 beats/min. In this case, the individual might extend the walking time to 1 hour to achieve benefit. However, a 40-year old with a brisk walking heart rate of 120 is in the target zone and needs not unnecessarily extend the exercise time.

CAUTION: As with any strenuous exercise, over-exertion, particularly in hot climates, can be hazardous. Team sports, running under the buddy system, and swimming with a life guard on duty are all acceptable safety measures.

Figure 14-3. Leg Press. Performed from a seated position with the feet on the pedals. The legs are extended, pressing the feet forward until the knees are slightly bent, but not locked in a fully extended position. Pause briefly and return to the starting position. The buttock and back regions should maintain contact with the seat at all times and the back should not be arched.

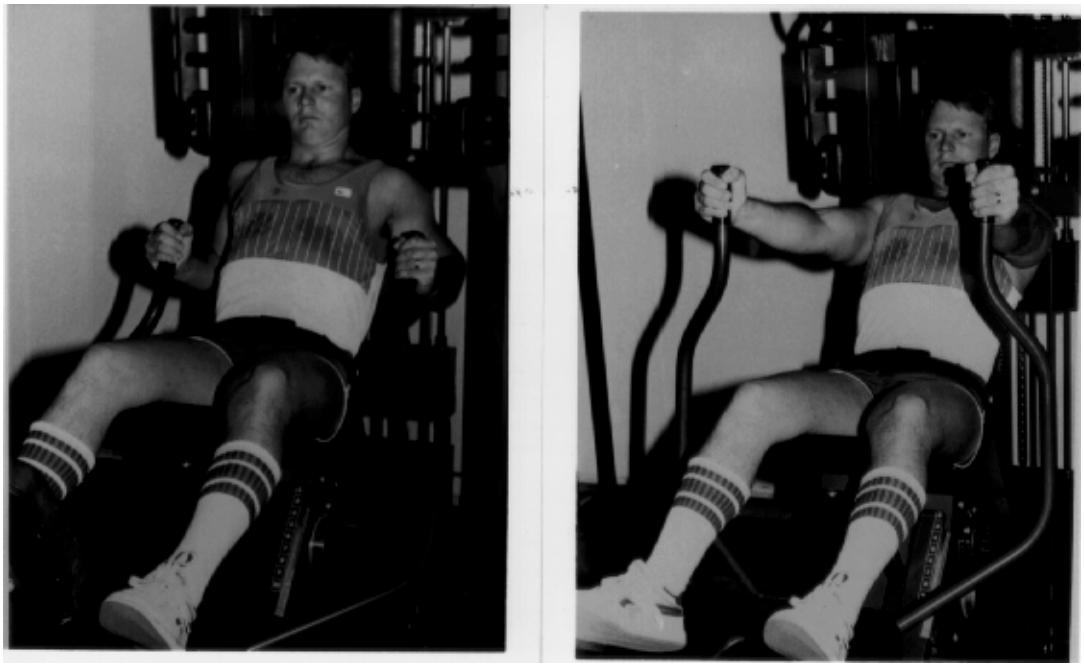

Figure 14-4. Bench Press. Performed from a supine or seated position (depending on the apparatus available) with the lifting bar or grips in line with the middle of the chest. The bar or grips are pressed to obtain full arm extension and then returned slowly to the starting position. The head, shoulder, and buttock regions should remain in contact with the bench or seat throughout the exercise and the back should not be arched.

Figure 14-5. Lat Pull. Performed by sitting or kneeling beneath the pulley, gripping the bar as preferred (wide or narrow grip, palms in or out), and pulling to either the chest or to behind the head position. After a brief pause, arms are fully extended, returning the bar to its original position.

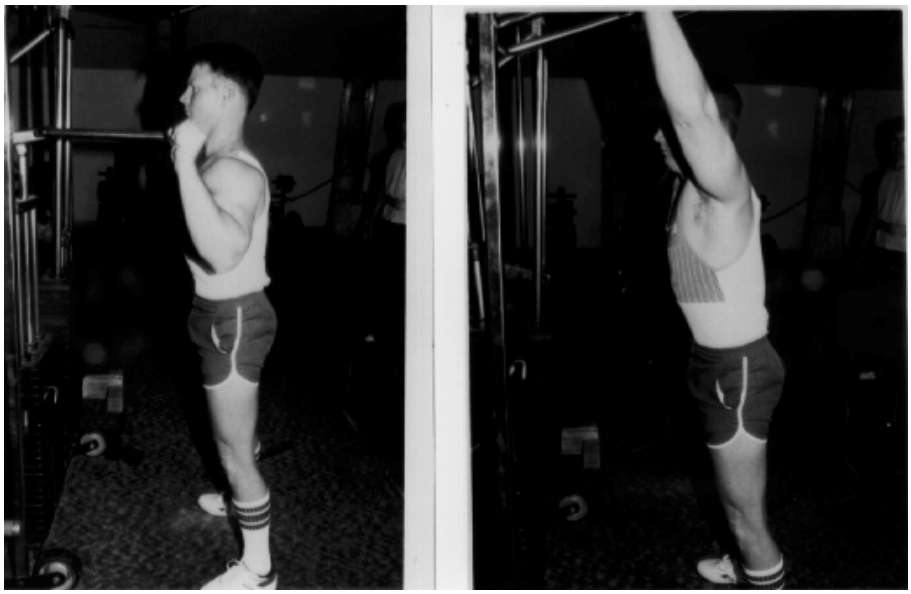

Figure 14-6. Military Press. Performed from a seated or standing position facing the machine. The lifting lever is gripped and pressed upward to the full arm extension position. After a brief pause, the lever is returned to the starting position with the bar at shoulder level. The neck and back should not be arched throughout the exercise.

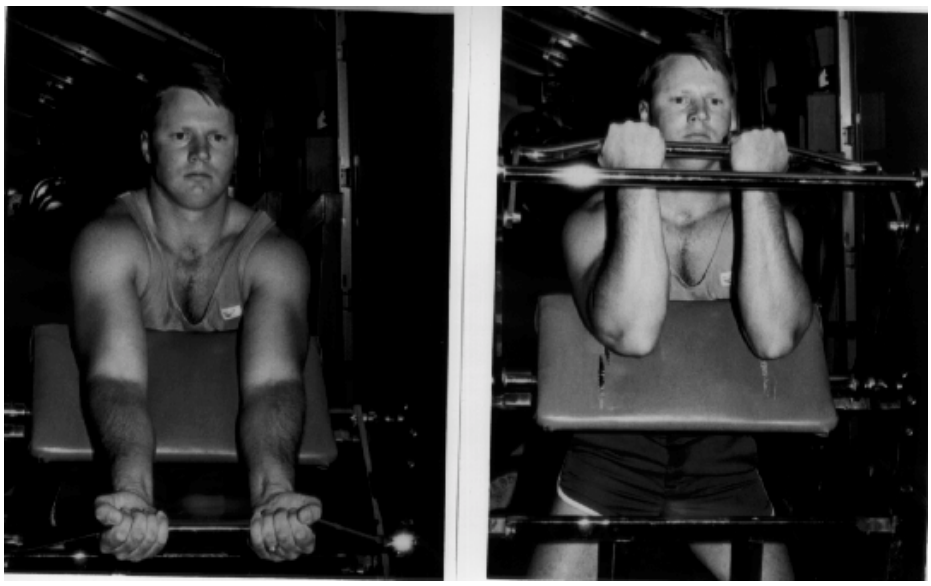

Figure 14-7. Arm Curl. Performed from a seated or standing position with an underhand grip on the bar. Arms should be fully extended downward, elbows against the trunk but not braced (standing) or on pads (sitting). The arms are flexed upward keeping the elbows against the trunk (standing) on pads (sitting).

Figure 14-8. Sit-up. Performed on an incline board with knees bent and hands clasped on head. Movements should be slow and steady, not ballistic. As the sit-ups become easier, the board should be inclined at steeper angles to increase the difficulty.

Figure 14-9. Leg Raise. Performed on an incline board, from a hanging position on the chinning bar, or from the leg raise apparatus on some equipment. The movement involves raising the legs upward, either straight or bent, until a 90 degree hip flexion position is achieved. Then, the legs are lowered slowly to the starting position. Avoid arching the neck or back during the movements.

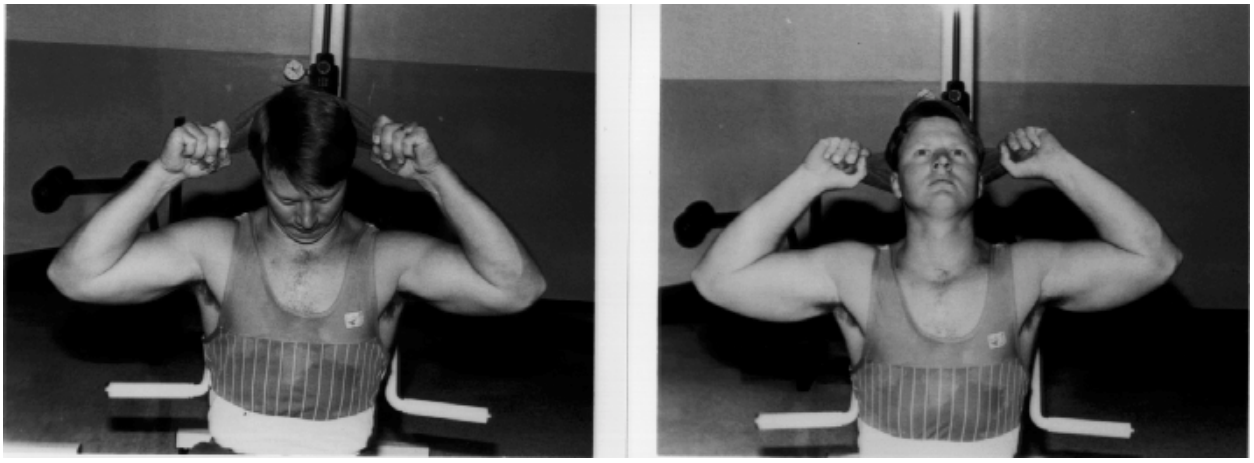

Figure 14-10A. Neck Series Performed in sitting or standing position. Use a cloth or hands clasped behind the head to provide resistance to the movement. Starting from a head upright position slowly tilt the head fully backward, then slowly return to the upright position while still applying pressure against the back of the head.

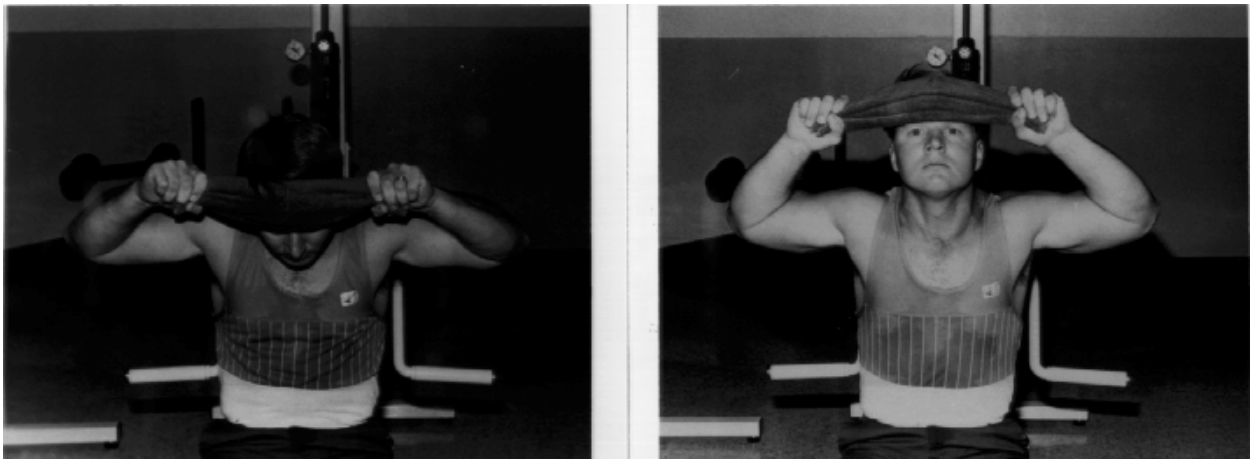

Figure 14-10B. Neck Series Performed in sitting or standing position. Use a cloth or hands clasped on the forehead to provide resistance to the movement. Starting from a head upright position slowly tilt the head fully forward, then slowly return to the upright position while still applying pressure against the forehead.

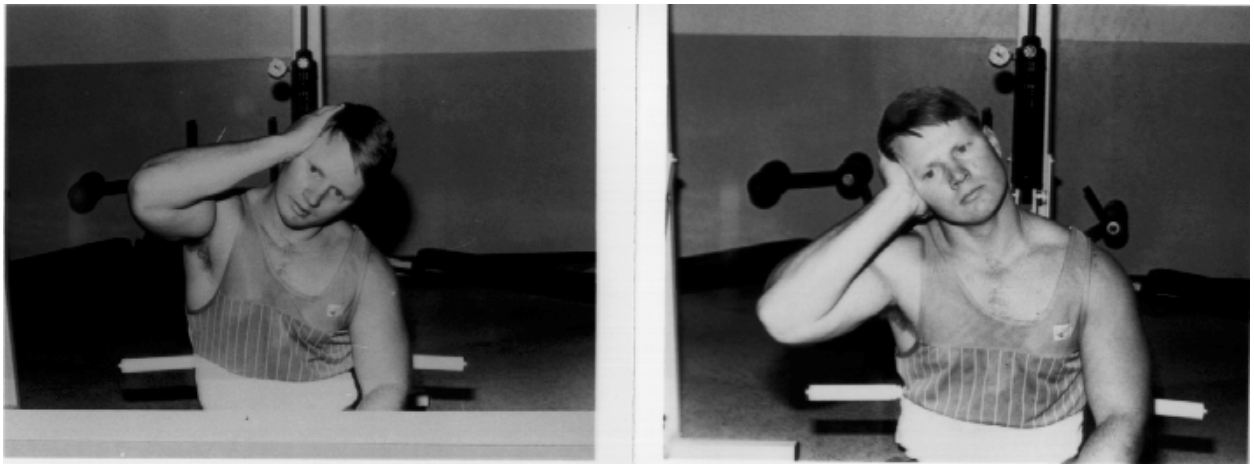

Figure 14-10C. Neck Series. position placing the right hand against the right side of the head. Applying resistance with that hand, slowly move the head toward the right shoulder. For the return movement place the left hand on the left side of the head and slowly return the head to the upright position. Repeat to the opposite side.

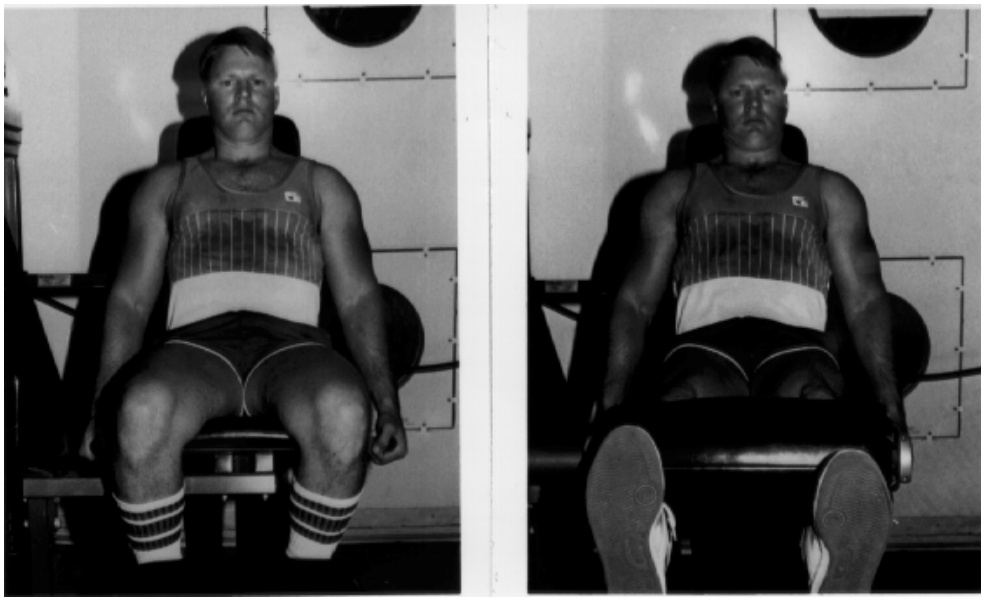

Figure 14-11. Leg Extension. Performed from a seated position using knee extension against a given resistance. Do not arch the back or raise the buttocks from the seat during the movements.

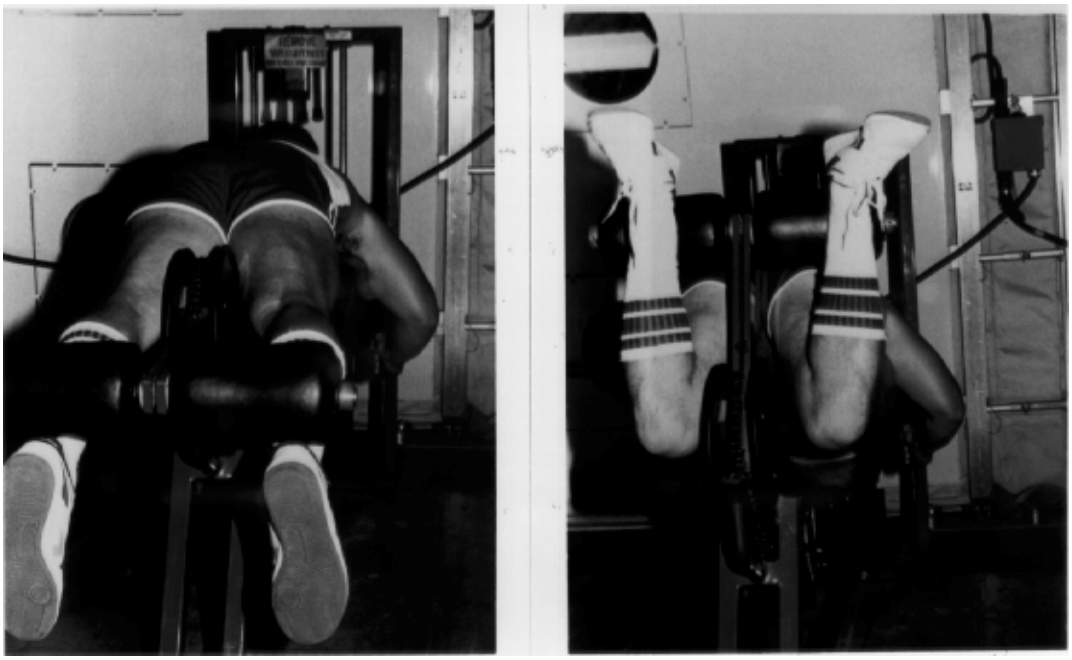

Figure 14-12. Leg Curl. Performed from a prone position and achieved by knee flexion. The pelvis should not be elevated from the bench.

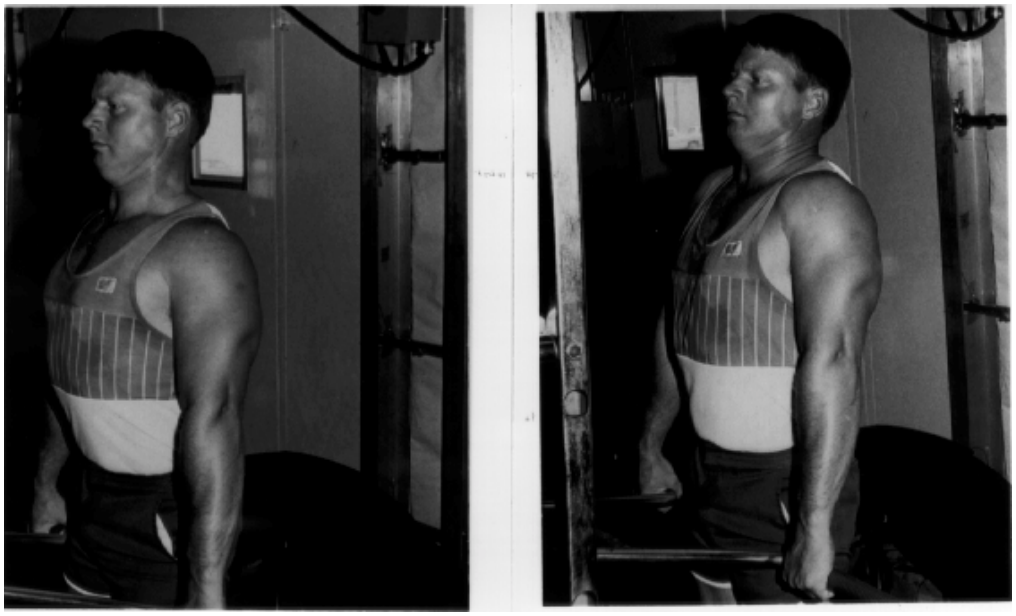

Figure 14-13. Shoulder Shrug. Performed by raising the shoulders while holding the bench press bar with the arms fully extended downward. The elbows should not be bent and the back and neck not arched during this movement.

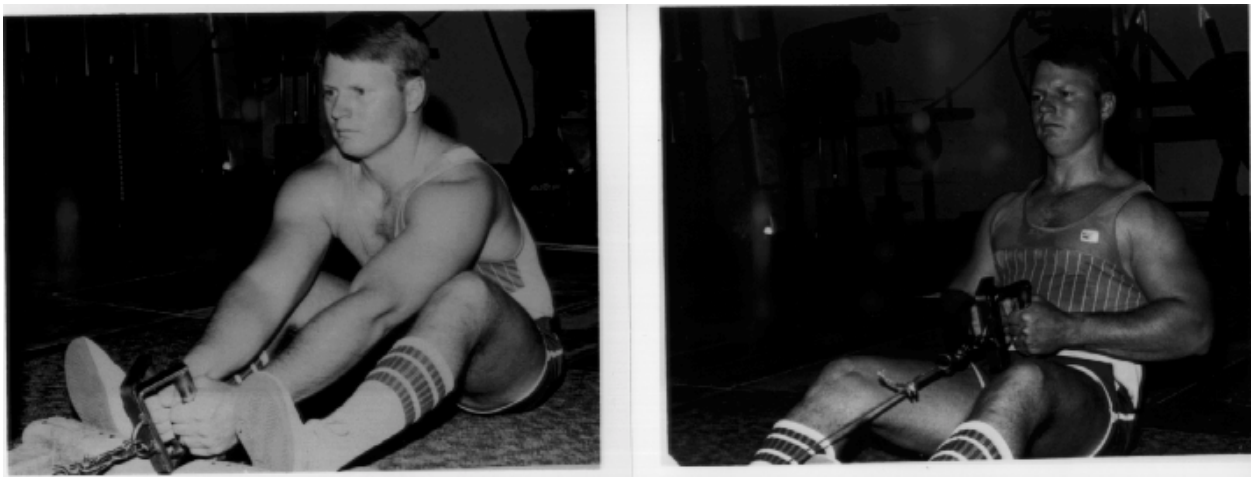

Figure 14-14. Seated Row. Performed by pulling against resistance with the feet braced and set into position. This is a two-handed exercise with alternate extension and flexion of arms. The hands are drawn into the chest with elbows held high and then allowed to extend. The upper body should not move forward or backward.

Figure 14-15. Upright Row. Performed by pulling upward against resistance while in a standing position. The hands, with a narrow overhand grip, are drawn upward to just under the chin with elbows raised and then slowly allowed to extend. The back and neck should remain straight.

Figure 14-16. Triceps Extension. Performed from a standing position with both hands on the pull bar, palms down, elbows bent and close to the body. The bar is pushed down with the elbows close to the trunk until the arms are fully extended.

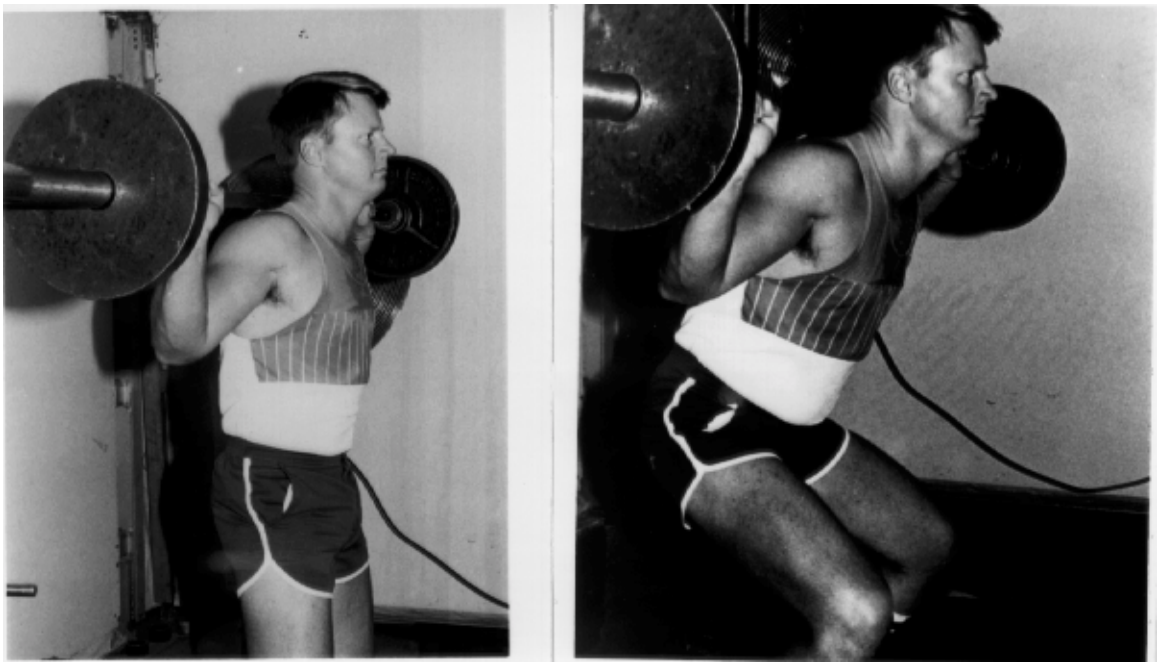

Figure 14-17. Squat. Performed with the bar resting on the shoulders. From a standing position, the knees are flexed until the thighs are at a 45 degree angle (quarter squat) or parallel (half squat) to the floor. After a short pause, the legs are extended to the standing position. The back should not be arched and a full squat is not advised. A spotter is recommended.

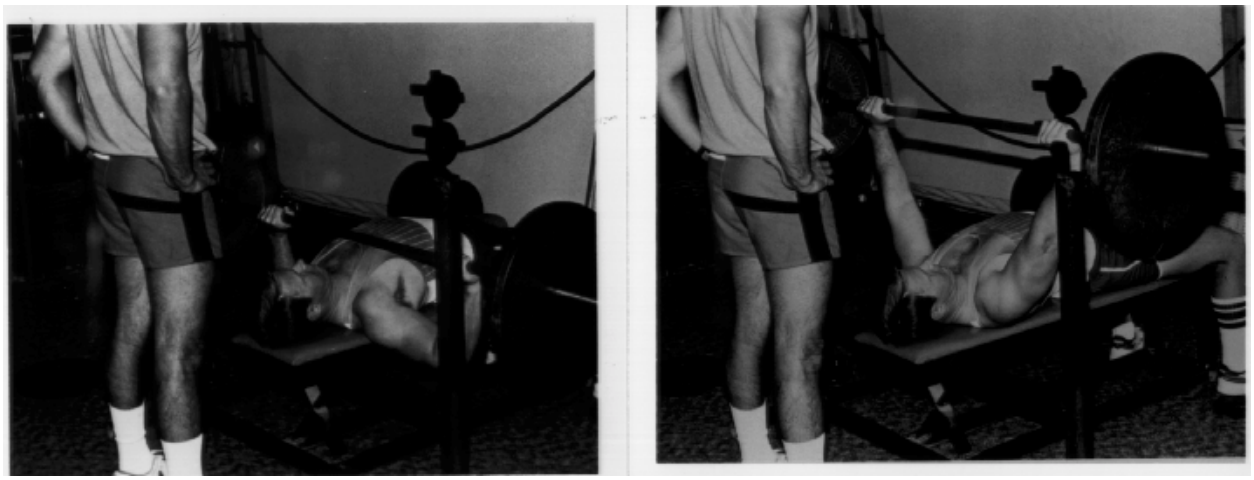

Figure 14-18. Bench Press. Performed from a supine position with the bar in line with the middle of the chest. The bar is raised upward to obtain full arm extension and the lowered slowly to the starting position. The head, shoulders, and buttocks should remain in contact with the bench throughout the exercise. A spotter is required.

Figure 14-19. Pull-up. Performed from a full extended body position suspended from a bar by a shoulder width overhand grip. Body sway should be minimal while it is being raised to elevate the chin above the bar and then slowly lowered to the original position.

Figure 14-20. Arm and Chest Pullover (Modified). Performed in the supine position on bench or the floor. Use a light weight (30 lb. or less). Start with the arms extended past the head and a maximum inhalation. Keeping the arms extended, slowly raise the weight over the head and down toward the lower abdomen exhaling as you go. Do not rest the weight on the body. Return to the start position by raising the weight in reverse, slowly inhaling to the maximum on return to the start.

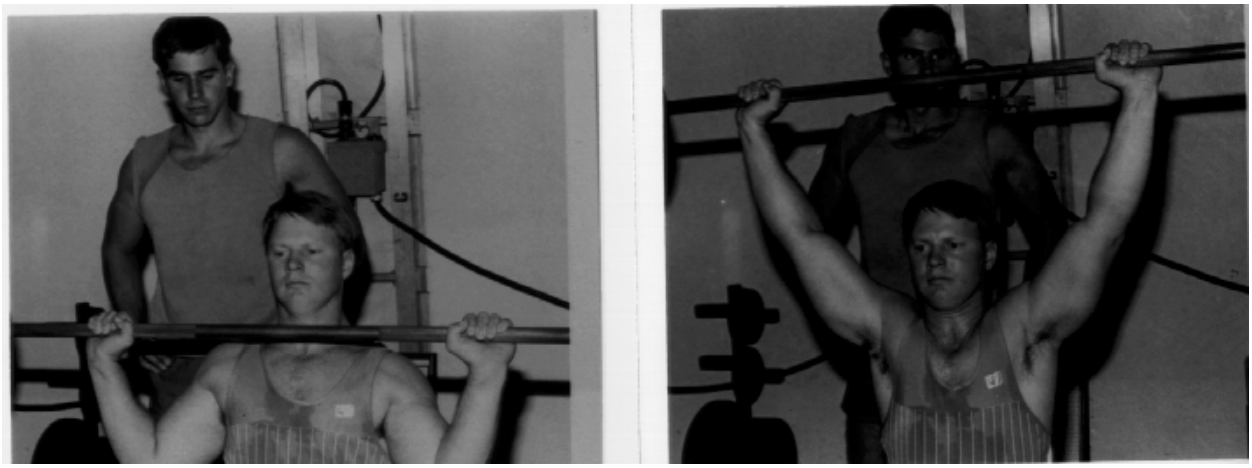

Figure 14-21. Military Press. Performed from a standing or seated position. Starting with the bar at the level of the collar bone, press it upward to the full arm extension position. After a brief pause, lower the bar to the starting position. The back and neck should not be arched. A spotter is recommended.

Figure 14-22. Arm Curl. Performed from a standing position with an underhand grip on the bar. Arms are fully extended downward and elbows against, but not braced, the trunk. Flex the arms upward keeping the elbows against the trunk and the back and neck straight.

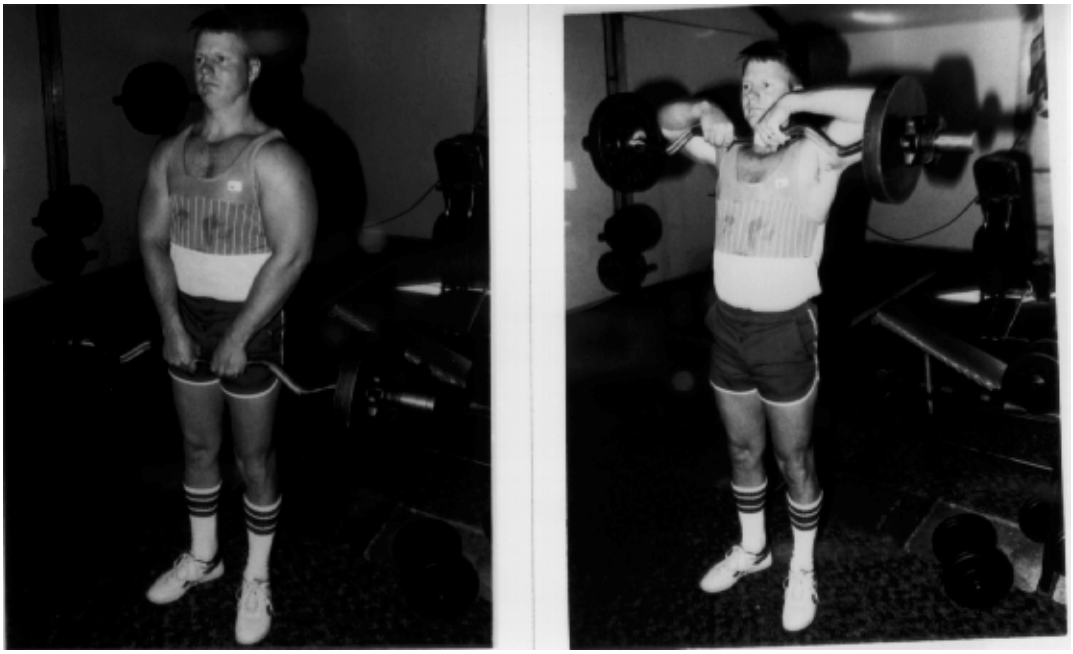

Figure 14-23. Upright Row. Performed from the standing position. The bar is elevated from the fully extended position to the level of the shoulders. After a brief pause, the weight is lowered to the original position. Do not arch the neck or back.

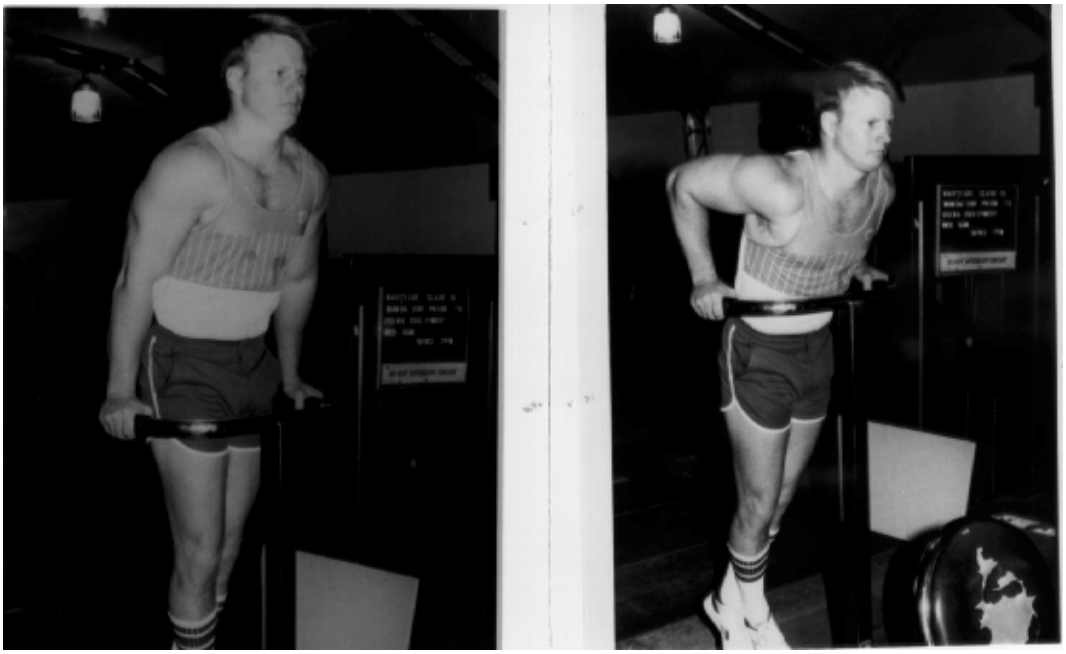

Figure 14-24. Bar Dip. Performed on parallel bars which support the body suspended above the floor with the arms fully extended. Lower the body until the upper arms are parallel to the bar. After a short pause elevate the body to the starting position. Minimize body sway during the exercise.

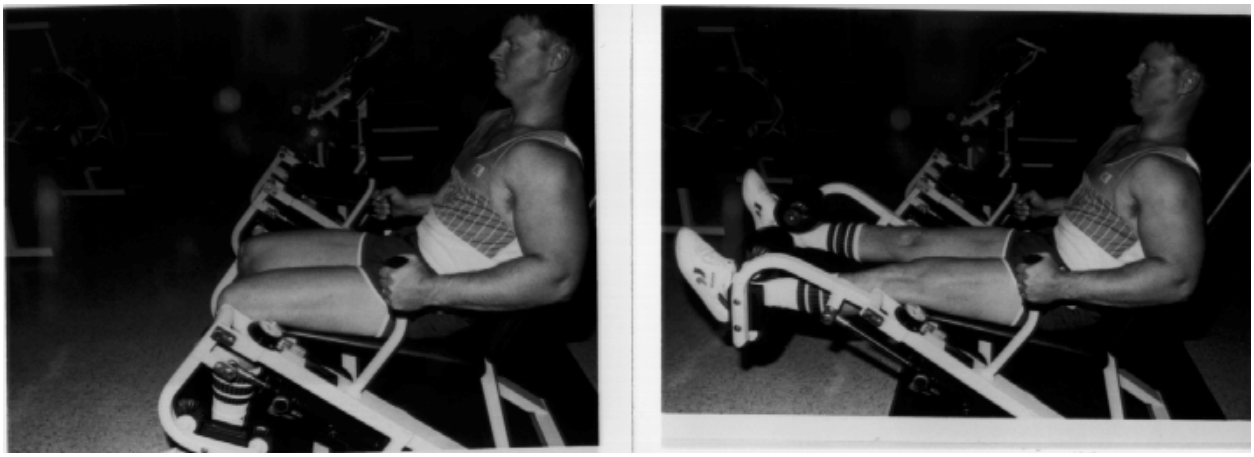

Figure 14-25. Knee Flexion and Extension. Performed from a seated position with the legs flexed at the knee. Legs are fully extended and the flexed against the resistance of the machine. Movement of the upper body should be minimal during the exercise. Movement of the legs should be smooth and continual.

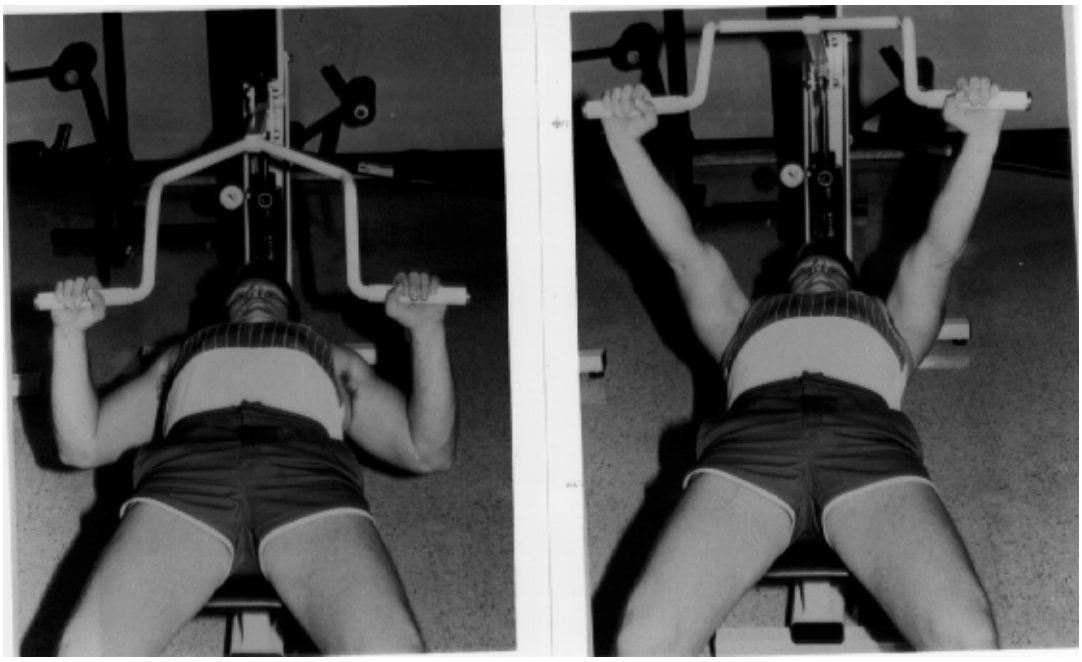

Figure 14-26. Chest Press and Row. Performed from the supine position with the arms flexed at the elbows. The arms are fully extended upward and then flexed back down toward the chest against the resistance of the machine. The back and buttocks should remain in contact with the bench throughout the movements and the feet should remain flat on the floor.

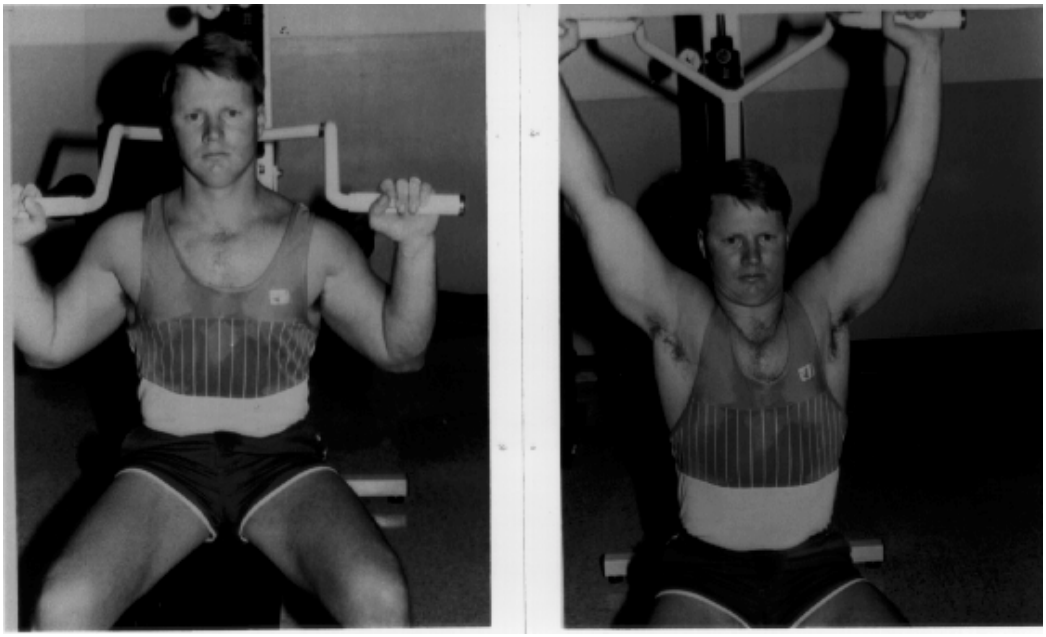

Figure 14-27. Shoulder Press and Lat Pull. Performed from a seated position with the arms flexed at the elbow. the arms are fully extended upward and then flexed back toward the shoulders against the resistance of the machine. Movement of the lower body should be minimal during the exercise and the back and neck should not be arched. The movement of the arms should be smooth and continual.

Figure 14-28. Abdominal and Low Back. Performed from a seated position with the arms extended at the elbows. The arms are fixed and the body is flexed at the waist fully forward and then fully backward. Movement of the upper body should be smooth and continual.

Figure 14-29. Neck Lateral Flexion. Performed from a seated position using the arms to stabilize the upper body. The head is fully flexed laterally. The neck is then flexed to the right then to the left. Movement of the chest should be minimal and movement of the head and neck should be smooth and continual.

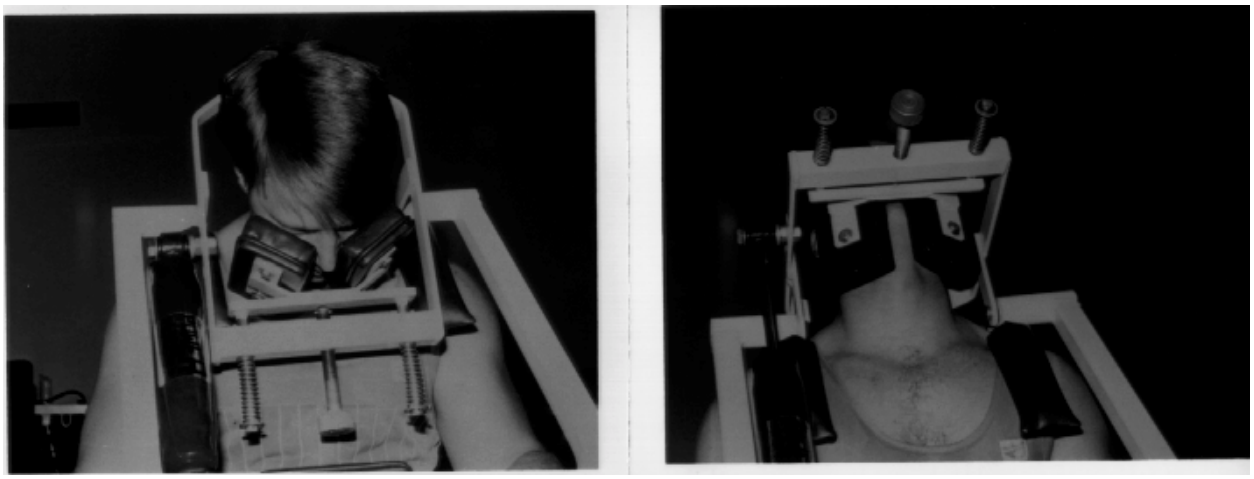

Figure 14-30. Neck Flexion and Extension. Performed from a seated position using the arms to stabilize the upper body. The head is fully extended posteriorly. The neck is then flexed forward and then extended backward again. Movement of the chest should be minimal and movement of the head and neck should be smooth and continual.

ATTACHMENT II

Major Nutrients And Diet Analysis

Carbohydrates are the starches and sugars in our diet and are divided into two basic groups, simple and complex. Simple carbohydrates include sugars normally found in the "coke and candy bar" type foods and drinks. Complex carbohydrates are made up of starches which include potatoes, rice, pasta, etc. The main function of carbohydrates is to provide energy for work. Additionally, they function in vitamin utilization and add flavor to foods.

Proteins are derived from both animal and plant sources. They are required for building and maintaining body tissues, enzyme and hormone production, and can serve as an energy source.

Fats are derived from both animal and plant sources and come in two general varieties, saturated and polyunsaturated. Saturated fats tend to be hard at room temperature and poly-unsaturated fats liquid or soft at room temperature. Fats perform a variety of body functions and like protein serve as an energy source.

Vitamins are substances which control body processes and are essential for a wide range of functions. The current consensus is that vitamin supplements are not needed for most people. A balanced diet consisting of a variety of foods should provide what the body requires.

Minerals are generally elemental substances that provide the body's basic structure for components such as hair, teeth, bone, etc. Minerals are such things as calcium, iron, sodium, etc. As is the case with vitamins, a proper and varied diet will provide the minerals the body requires for maximal performance.

Fiber is the "roughage" your grandmother used to talk about. Fiber is required for proper elimination of solid waste from the body and consists of such foods as fruits and vegetables, certain cereals and grains, etc.

The average American diet contains too much fat and protein and not enough complex carbohydrates. At first glance, fat sounds like a good thing to eat. After all it contains important essential acids, vitamins, improves the taste and texture of our food, and is the most concentrated source of food energy (twice as concentrated as protein and carbohydrates). A high fat intake, unfortunately, has some draw-backs. First, excess fat does not simply disappear. It is stored in the fatty tissues of the body. Secondly, diets high in fat, especially saturated fat, tend to elevate blood cholesterol. High levels of cholesterol in the blood are linked to formation of deposits in the linings of arteries, a condition associated with heart disease.

All of us grew up with the idea that athletes need to consume lots of protein. Unfortunately, most of us didn't know that the body only needed 5 to 7 ounces of protein per day. In our average diet we consume far more than this amount each day. The excess protein is not converted into muscle but into fat and stored in the body as such.

Most diets also contains too many simple carbohydrates. They offer little nutritional value except calories. Because "sugars" are well liked, it is easy to eat more of them than is necessary which can contribute to weight problems.

What's left? Complex Carbohydrates. Foods high in complex carbohydrates serve the athlete and fighter aircrew very well. They not only provide the body with minerals, vitamins, fiber, etc., but also are the best available source of energy. Water is required to "break" fat and protein down into energy for use in the muscles. This tends to dehydrate the body and reduce performance. On the other hand, complex carbohydrates are the body's prime source of glucose (basic energy unit). Each molecule of glucose holds six molecules of water which is released during exercise.

To summarize, what kind of diet will provide you with INCREASED ENERGY LEVELS and ENDURANCE CAPABILITY? For optimum levels of performance your diet should consist of approximately 60 percent (by calories) complex carbohydrates, 20 percent protein and 20 percent fat.

ATTACHMENT III

Microbiology of Flight Meals

Microbiological studies delineate the approximate temperature range of 50-130^{o} F as the zone in which food infection organisms multiply and toxins can be produced by microorganisms. The minimum incubation period for bacterial growth of hazardous proportions is generally five hours. The safe supply of perishable flight foods therefore demands: sanitary practices to preclude inoculation of pathogens during food preparation and to reduce all bacterial contaminants in number; holding at incubation temperatures (above 45^{o} F) no longer than 5 hours before consumption; and maximum use of refrigeration (below 45^{o} F), or alternatively heating to above 140^{o} F for continuous periods before serving.

These principles apply to any type of inflight perishable meal items (for example sandwiches, snack lunches, and hot meals), whether originating from flight kitchen, commercial courses, or household supplies. Individual packaging in disposable, sanitized containers is a desirable supplementary protection in view of the limited hygienic facilities of military aircraft.

Repeated bacteriological analyses have been made on the perishable in-flight foods, especially the more complex precooked frozen meals. The bacterial counts are sufficiently low to indicate minimal hazard in such feeding, provided that carefully supply procedures are followed. Aircraft food heating equipment must provide temperatures above 165^{o} F which will inhibit and often destroy food bacteria of pathogenic significance. However, such high temperatures will not inactivate the more stable enterotoxins if already formed in food prior to heating. Complete cooling or freezing is the essential of all protracted periods of transport and storage.

The establishment of consistent bacterial safeguards greatly determines the types of food perishables that can be utilized in aircraft. This is dependent upon the efforts and training of personnel directly responsible for the conduct of flight feeding in the operational commands. The references at the end of this chapter provide further guidance on sanitary food management.

ATTACHMENT IV

Possible "Gas Formers"

Fruits
Avocado
Melons
Raw apples

Vegetables
Beans (especially soybeans)
Broccoli
Brussels sprouts
Cabbage
Cauliflower
Corn
Cucumbers
Green peppers
Lentils
Onions (including leeks, scallions, shallots)
Pimentos
Radishes
Rutabagas
Sauerkraut
Turnips

Meats
Soy-extended ground beef and beef patties

Breads and Cereals
Doughy breads (heavy, not completely baked)
Bran cereals and breads

ATTACHMENT V

Caffeine Content

Product	Caffeine (Milligrams)
Coffee (5 oz.)	
Brewed, drip method	80
Brewed, percolator	80
Instant	65
Decaffeinated, brewed	3
Decaffeinated, instant	2
Tea (5 oz.)	
Brewed, major US brands	40
Brewed, imported brands	60
Instant	30
Iced (12 oz. glass)	70
Choc fudge topping 1 T	2
Cocoa beverage (5 oz.)	4
Chocolate milk beverage (8 oz.)	5
Milk chocolate (1 oz.)	6
Dark chocolate, semisweet (1 oz.)	20
Pudding, chocolate Jell-O (1/2 cup)	5
Carnation Instant Brkfst, coffee (1pkt)	36
Baker's chocolate (1 oz.)	26
Dexatrim Capsules (per capsule)	200
Nodoz Tablets (per tablet)	100
Anacin (per tablet)	32.5
Midol (per tablet)	32.4
Coricidin (per tablet)	30

ATTACHMENT VI

Caffeine Content of Soft Drinks

Brand	Caffeine (Milligrams)
Mountain Dew	54
Mello Yellow	53
TAB	47
Coca-Cola	46
Diet Coke	46
Shasta Cola	44
Shasta Cherry Cola	44
Shasta Diet Cola	44
Mr. PIBB	41
Sugar-Free Mr. PIBB	59
Dr. Pepper	40
Sugar-Free Dr. Pepper	40
Big Red	38
Sugar-Free Big Red	38
Pepsi-Cola	38
Diet Pepsi	36
Pepsi Light	36
RC Cola	36
Diet Rite	36
Canada Dry Jamaica Cola	30

Attachment VII:
PUTTING PREVENTION INTO PRACTICE

Larry L. Dickey, M.D., M.P.H.

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The importance of preventive care is increasingly recognized by physicians, patients, and health care policy makers. Every major proposal for health reform has included an emphasis on preventive care. Family physicians should be well-qualified and well-positioned to take advantage of this new emphasis on preventive care. However, studies have found that family physicians, like other primary care practitioners, fall short in delivering preventive services as recommended by major authorities. For example, only 20-40% of adults receive the immunizations they need, and 40-50% receive necessary screening tests.

Several office-based methods and tools have been developed and tested to help primary care practitioners improve their delivery of preventive care. (Some of these were discussed in the December 1989 issue of *HELP*, "Preventive Services in the Office.") Overall, dissemination and use of office methods and tools has been slow. To help change this situation, the U.S. Public Health Service recently developed the "Put Prevention Into Practice" (PPIP) campaign in partnership with the American Academy of Family Physicians and other national organizations.

PPIP is unique as the first national campaign designed to improve the delivery of a full range of preventive services. Other campaigns have focused on specific preventive services such as blood pressure or cholesterol screening. PPIP also differs from most campaigns in targeting not only physicians, but office/nursing staff and patients as well. Integral to the PPIP campaign is a set of special office tools developed to assist in delivering preventive care.

This issue of HELP outlines key steps for improving preventive care services in clinical practice and describes how family physicians can use PPIP tools and other resources to meet the emerging challenge of preventive care.

Establish a Protocol

Deciding what to do in your practice is the first and most important step in delivering preventive care. Establishing a protocol can be difficult for several reasons. Modern preventive care is multifaceted, including screening tests, immunizations, prophylaxis and counseling. Moreover, differing recommendations are issued by many different authorities, and recommendations change frequently.

It is important to realize that there is basic agreement among authorities about recommendations for most types of preventive care. A reasonable minimum set of preventive services for any practice consists of the preventive services which have been recommended by all major authorities (figure 14-31).

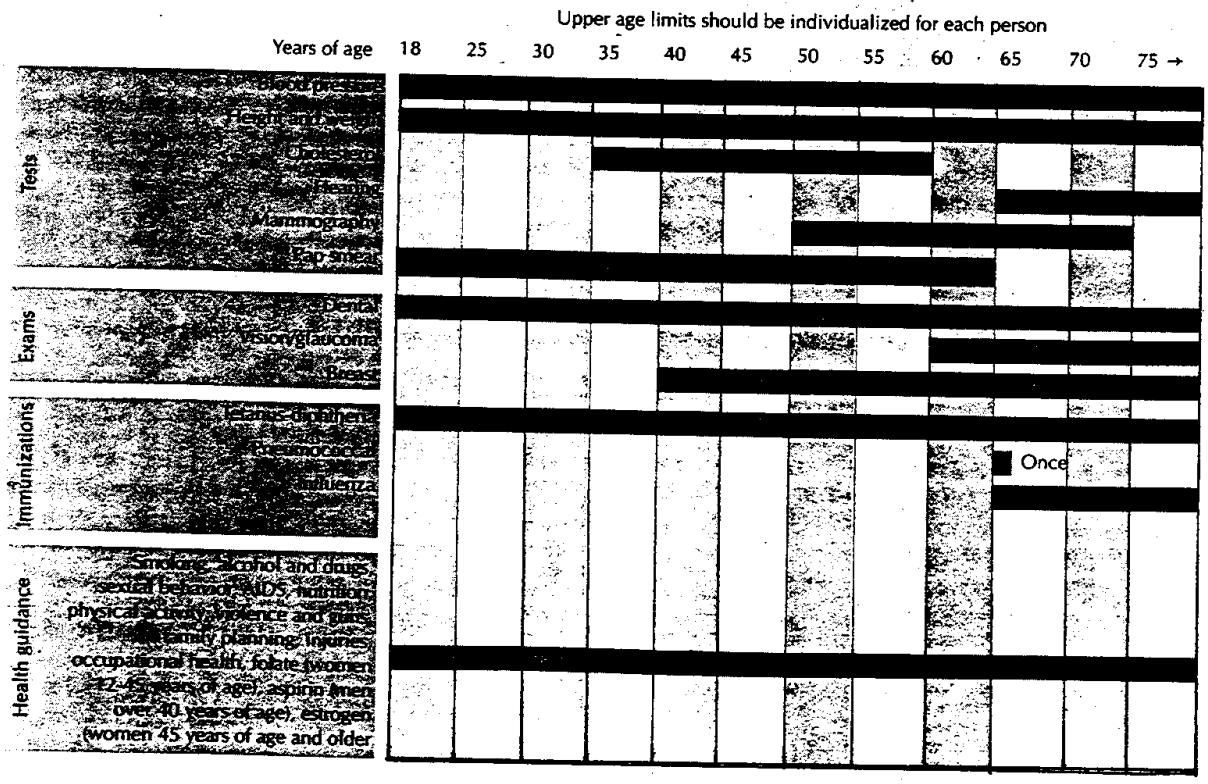

Figure 14-31. This set of preventive care services recommended by all major authorities can be used as the core of a preventive care protocol for adults in your practice. It is adapted from the Adult Preventive Care Timeline developed by PPIP. The adapted version excludes a second set of recommendations made by some major authorities.

This core set of preventive services corresponds closely to that recommended by the U.S. Preventive Services Task Force (USPSTF) in the 1989 Guide to Clinical Preventive Services (see "Resources" at end of attachment). The USPSTF, convened by the U.S. Public Health Service, has been praised widely for the quality of its evaluation of scientific evidence. AAFP recommendations for periodic health exams for specific age groups are based on those of the USPSTF (see "Resources").

The preventive care protocol which you design for your practice should be tailored to the risk factor characteristics of your patients. For example, if a high percentage of your patients are immigrants or otherwise at risk for tuberculosis, it is reasonable to include tuberculosis screening in your preventive care protocol for all patients. You can consult with local and state public health departments to identify the risk factors of most importance to your community.

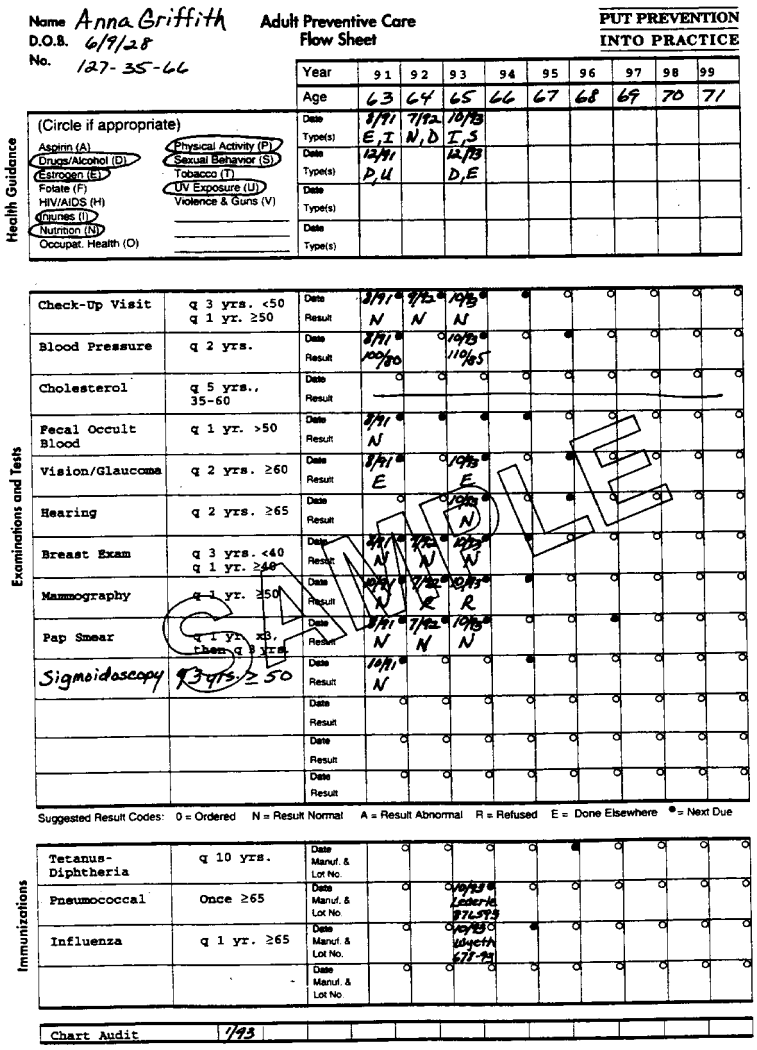

Figure 14-32. This sample preventive care flow sheet is individualized for an older adult patient with specific needs.

Because the list of potential risk factors and needed preventive services is lengthy, even practitioners in communities at low risk for preventable diseases will have some patients at high risk. It may be useful to include certain preventive services in your protocol just for high-risk patients. Most major authorities, including the USPSTF and AAFP, have issued recommendations regarding risk factors of importance for preventive care. For reference, these recommendations are compiled in summary risk-factor tables (e.g. family history, medical history) in the PPIP *Clinician's Handbook of Preventive Services*.

It is important to formalize your practice's preventive care protocol in writing and post it for easy reference in several locations, including exam rooms, nursing stations, and patient charts. Implementing your protocol will require the use of some basic office tools, involvement of staff, and participation of patients. In addition, you will need a method of monitoring your practice's performance to assure that you are providing preventive care according to your protocol.

Utilize Office Tools

The use of office tools and other practice aids is crucial for timely and consistent delivery of preventive care. Clinical trials have demonstrated the effectiveness of several types of simple office tools in increasing preventive care delivery rates. In addition to tracking devices and various prompts described in this section, patient activation tools are outlined later in this article.

Tracking Devices. The most basic and essential tool is a tracking device, such as a flow sheet in patient charts or computer tracking software. In one survey of AAFP members, 73% reported using a flow sheet; however, other studies have found the manner in which physicians use flow sheets to be suboptimal, with as many as 50% not being filed with data.

The PPIP kit includes reproducible copies of three preventive care flow sheets. A child immunization flow sheet is complete and ready for use. An adult and a child preventive care flow sheet are designed to be tailored to your practice. Each needs to be prepared according to your practice protocol, then duplicated and individualized to the needs of patients as they are seen (figure 14-32). The kit provides directions for customizing the flow sheets and for using a dot system that will allow you and your staff to quickly assess a patient's preventive care needs by looking at one sheet.

Although software programs are highly effective for tracking preventive care, they are used by few family physicians. Several design factors still need to be worked out. If you are considering a software program for preventive care, investigate its compatibility with other software used in your practice such as your patient billing program. You may want to consult an article scheduled for publication in the Journal of the American Board of Family Practice, which reviews computerized heath maintenance tracking systems and recommends necessary and optional features of efficient, cost-effective systems in primary care (see "Resources").

Prompts. Various paper-based prompting tools are effective in improving rates of preventive care delivery. Each of these provides a reminder to you and/or your patients about needed preventive care. Prompting tools in the PPIP kit include:

- *Reminder postcards*- a cost-effective way to encourage patients to schedule needed preventive services.

- *Alert notices*- colored stickers to place on patient charts as reminders of ongoing needs for preventive care, such as smoking or alcohol abuse, and self-sticking removable notes to remind you to provide preventive care at specific visits.

- *Charts and posters*- waiting room posters to provide the message that prevention is a priority for the practice, and exam room charts on preventive care which have a dual purpose: education for patients and quick reference for clinicians.

- *Prevention prescription pads*- to provide brief written instructions of diet change, exercise, and other types of preventive care. These can also be used as patient contracts with pressure-sensitive copies that can be retained in patient charts.

Involve Staff

An effective program of preventive care will capitalize on the skills of nursing and office staff. A number of tasks can best be handled as routine responsibilities of staff. Office staff can issue patient reminders, record data, check patient flow sheets before visits and add physician reminder notices. They can follow up on screening test results and assist patients in finding helpful community resources for counseling and other preventive services.

Staff members also can obtain and display preventive care posters and brochures in the office and insert selected patient education materials in patient charts before appointments. Nurses and other professional staff can provide much of the needed instruction and counseling, e.g., diet, exercise, smoking cessation as well as other preventive care, such as immunizations and some screening tests. Some authorities recommend that a staff person be designated to serve as the preventive care coordinator for the practice.

Activate Patients

Patients are very interested in preventive care, as several studies have demonstrated. They are a major potential force for promoting preventive care that clinicians often overlook. A useful tool for involving patients in their own care is a patient-held minirecord.

The PPIP campaign has created the *Personal Health Guide* for adults and the *Child Health Guide*. These passport-sized booklets include record forms for patients to track and prompt their own preventive care along with basic information about preventive care and limited health risk appraisal. It's important to establish a practice routine for using the *Guides*, e.g., ask patients to bring them back each visit and give them to the receptionist or nurse for entering data or cross-checking preventive care records.

Perform Preventive Care Correctly

To be of value, preventive care must be performed correctly, If done incorrectly, some types of preventive care such as immunizations can be directly harmful. Screening tests can be indirectly harmful by failing to detect treatable disease or by leading to unnecessary diagnostic tests. Incorrectly performed preventive care leads to needless costs and risks.

Helpful information about performing preventive care can be difficult to acquire. Preventive care receives little attention in medical training, and information about preventive care is published in a wide variety of sources difficult to monitor.

The *Clinician's Handbook of Preventive Services* is designed to address this problem by providing current, concise guidance on all types of preventive care. The *Handbook* includes recommendations of leading authorities on who should receive each type of preventive care, practical tips on delivering the care correctly, and lists of patient education resources and references. It is intended to serve as a handy reference for use by the busy practitioner as the clinical situation requires.

Monitor Your Progress

As you implement your preventive care protocol, it is essential to build in some method to check on its effectiveness. You might use simple questionnaires to gather feedback from staff and patients on how well your basic approach and tools are working. Periodic audits with as few as 20-30 randomly selected charts can provide useful information as to how well your protocol is being implemented. What works for one practice may not work best for another. the important thing is to find out what works best for yours. With an organized approach and the use of basic tools, you and your staff can increase the quantity of preventive care delivered in your practice and impact the overall quality of care provided to your patients.

RESOURCES

- Guide to Clinical Preventive Services: An Assessment of the Effectiveness of 169 Interventions. Report of the U.S. Preventive Services Task Force. Baltimore: Williams & Wilkins, 1989. (A new edition is scheduled for release in later 1995.)

- Put Prevention Into Practice Kit. A kit designed by the U.S. Public Health Service, which includes all the practice items mentioned in this article. (*Editor's note: This kit has been purchased in bulk by USAF Health Promotions and a kit will be given to each health care provider. Ask around to make sure you get your* kit.)

- Clinician's Handbook of Preventive Services. The Handbook is part of the PPIP Kit. It can also be purchased separately at medical bookstores or through the U.S. Government Printing Office.

- Computerized Health Maintenance Tracking Systems: A Clinician's Guide to Necessary and Optional Features. It is scheduled to be published in May in the Journal of the American Board of Family Practice 1995:8(3).

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