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                 Fort Detrick, Maryland  21702-5012

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**Evaluation and Analysis of Priorities for the Defense Women's Health Research Program**

**National Academy of Sciences**
Institute of Medicine
Washington, DC 20418

**U.S. Army Medical Research and Materiel Command**
Fort Detrick, MD 21702-5012

Approved for public release; distribution unlimited

This report, prepared by an expert committee of the Institute of Medicine, identifies gaps and strengths in past and current research relating to the health and performance of military women, and provides guidance on establishing research funding priorities. Overarching recommendations deal with basic funding considerations for awards; important health questions related to racial or ethnic group membership; peer review; the promotion of information exchange; and the promotion of strong collaborative partnerships involving Department of Defense intramural efforts, established academic institutions, federal research programs, and civilian research programs. The committee recommends long-term commitment to research focused on the health of military women and the development and maintenance of databases to support this research, including longitudinal research.

The committee's recommendations of specific topics for research fall into four broad areas:

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Alison Yates

PI - Signature

July 1995

Date
Recommendations for Research on the Health of Military Women

1995
Recommendations for Research on the Health of Military Women

Committee on Defense Women's Health Research

INSTITUTE OF MEDICINE

NATIONAL ACADEMY PRESS
Washington, D.C. 1995
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The serpent has been a symbol of long life, healing, and knowledge among almost all cultures and religions since the beginning of recorded history. The image adopted as a logotype by the Institute of Medicine is based on a relief carving from ancient Greece, now held by the Staatlichemuseum in Berlin.
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Preface

This report concerns a special group of women—active duty and reserve members of the U.S. Armed Forces. Their combined number approaches 350,000 and is growing. These women are vital to the conduct of military operations, and they must be fit and healthy to fulfill their military responsibilities. At the same time, they confront health risks and special situations that few other U.S. women encounter.

In response to congressional action, the Defense Women’s Health Research Program was established to address the health of military women, especially as related to mission readiness, deployment, and training. This program is managed by the U.S. Army Medical Research and Materiel Command (the Command).

The Command asked the Institute of Medicine (IOM) for advice related to the program’s use of the FY 1995 $40 million appropriation. In particular, the IOM was asked to focus on two main topics: (1) gaps and strengths in past and current research relating to the health and performance of military women, and (2) guidance on establishing research funding priorities. The IOM appointed a 19-member committee with expertise in internal medicine, obstetrics and gynecology, dermatology, nursing, physiology, physical education/kinesiology, nutrition, pharmacology, psychiatry, psychology, social work, epidemiology, design of protective clothing, occupational and environmental health, and women’s health. Of these committee members, eight had previous experience as a member of or a consultant to the Armed Forces. One committee member is a retired female Army officer and one is currently a female officer in the Naval Reserves and a member of the Defense Advisory Committee on Women in the Services (DACOWITS).
The committee addressed research in four general areas: clinical, occupational/environmental, physiological, and psychiatric/psychosocial issues. Part of the committee's work was conducted by working groups in those four areas. The primary focus was on the safety, health, and military effectiveness of military women, especially those deployed for training or operations in austere conditions.

The Command asked the committee to conduct an extensive search of relevant studies from the published literature and from government reports of funded research and to draw on the search results in preparing its report. The committee was further charged to recommend defense women's health research areas to be supported and to provide guidance for developing funding priorities. The extensive reference lists are included in a separate volume entitled *Recommendations for Research on the Health of Military Women: Bibliographies* and in an electronic database that also contains available abstracts. This report is to be used in the preparation of a Broad Agency Announcement about the research program and other aspects of program administration.

Because of the Command's need to disperse FY 1995 funds, the time frame for the committee's work was unusually short. Between mid-April and the end of May 1995, members assisted with the search strategies and processed large amounts of information, the working groups conferred, and the full committee met three times, deliberated, and developed its recommendations. The appendices reflect only a portion of the information that was processed. The committee's extraordinary effort testifies to its view that the Defense Women's Health Research Program is an important program that is capable of supporting the best research and scientific effort, and is deserving of careful planning, management, and oversight.

The committee views the Defense Women's Health Research Program as an invaluable means of improving the health of military women and of women in general. The population of military women is unrivaled as a source of data that can be used to great advantage in studies to improve the short- and long-term health of young women of varied racial and ethnic backgrounds. The committee is concerned that the temporary nature of the funding limits the kinds of studies that can be undertaken. A stable funding base would permit more rigorous and longer-term studies of major impact on the health, well-being, readiness for deployment, and performance of military women, as well as providing information pertinent to the health of civilian women.

The chair and the committee are appreciative of the large staff provided to the committee. We especially wish to thank Kenneth I. Shine, IOM president; Karen Hein, executive officer; and Allison Yates, division director, who were instrumental in initiating the study. We especially appreciate the excellent work of Carol Suitor, study director, and the assistance of Rick
Manning and Paul Thomas, senior program officers; Cathy Liverman, who conducted the literature searches with assistance from librarians Laura Baird and Julie Walko; research assistants Carolyn Peters and Laura Colosi; project assistants Thomas Wetterhan and Patricia Takach; managing editor Mike Edington; and editors Florence Poillon and Linda Humphrey. We also wish to thank COL Irene Rich, Director, Research Area Directorate VI, Department of the Army, U.S. Army Medical Research and Materiel Command, for expediting information gathering, and the many members of the Armed Forces who provided information and perspectives to the committee.

The committee believes that the separately published bibliography of relevant literature and studies in progress, together with the committee’s recommendations for new research, provide a useful basis for planning and implementing research for the military and civilian research communities.

Luella Klein, Chair
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Summary

Approximately 340,000 women serve in the Armed Forces. They constitute 14 percent of the total active duty personnel and 16 percent of reservists; 40 percent of these women belong to a minority group. Military women (a term that applies to both active duty servicewomen and women in the reserve component) are generally young, healthy, and fit. However, from basic training to deployment in combat, military women experience physical challenges and psychological stresses that may include overuse injuries, feelings of loneliness and isolation, exposure to environmental extremes, and sexual harassment, as well as the need to cope with military equipment, clothing, and procedures designed largely for men.

To support research aimed at addressing the health-related needs of this population, the Defense Women's Health Research Program (DWHRP) was established in FY 1994. Congress provided $40 million to the Department of Defense (DoD) in both FY 1994 and FY 1995, with the promise of additional funding in subsequent years, for intramural and extramural research relevant to the goals of the DWHRP. Those goals relate to mission readiness, deployment, and training. The DWHRP is managed by the U.S. Army Medical Research and Materiel Command (the Command).

The Command asked the Institute of Medicine (IOM) for guidance on the use of the appropriations for the DWHRP. Particular attention was to be directed toward such topics as psychological stressors, physiological stressors, nutritional status, occupational safety issues, design of equipment and clothing, and special health care needs—all as related to servicewomen in training or deployment situations. In response, the IOM appointed a 19-member committee (1) to identify gaps and strengths in past and current research
overarching recommendations

The committee recommends that the following criteria be applied in setting priorities for those proposals that meet the basic funding considerations of scientific rigor and expertise of the investigators to conduct, complete, and disseminate research findings. The research problem or question should be:

1. **unique** to military women (e.g., a study of the potential reproductive toxicity of chemical weapons or medications used to counter them), or
2. especially **prevalent** among military women (e.g., a study of rapid diagnosis and treatment of sexually transmitted disease, or of stress fractures and other overuse injuries common in basic training), or
3. related to the ability of military women to **perform their mission responsibilities** (e.g., a study of the effect of premilitary abuse on response to violence and trauma).

Although the term “military women” applies to active duty servicewomen and women in the reserve component, the use of civilians or animals as subjects may be appropriate in some studies. Military women themselves are a key source of information and insights for investigators, and they should be involved in identifying their health concerns and investigating the solutions.

The committee recognizes the unusually large proportion of servicewomen from minority racial and ethnic groups. It strongly urges researchers to go beyond the statutory requirement for analysis of research by gender and minority subgroup (Defense Authorization Act for Fiscal Year 1994) and to actively promote studies that provide useful information about relationships, if any, between group membership and the health of women in the military.

To ensure maximum return for DoD’s fiscal investment in women’s health research, the committee proposes that rigorous peer review criteria be established and used for both intramural and extramural research.

The committee urges the Command to promote information exchange that can lead to strong collaborative partnerships involving DoD intramural efforts,
SUMMARY

established academic institutions, federal agencies, and civilian research programs. A few examples include joint sponsorship of workshops and seminars; preparation of information packets for applicants; award of small grants explicitly to promote collaboration of outside investigators and their access to military populations; and encouragement of civilian scientists to explore opportunities for collaboration by visiting military laboratories. Furthermore, the committee urges the Command to require that intramural as well as extramural DWHRP awardees document and share their research findings by submitting manuscripts for publication in scientific, peer-reviewed journals.

RECOMMENDATION FOR LONG-TERM RESEARCH ON THE HEALTH OF MILITARY WOMEN

The committee recommends that DoD make a long-term commitment to research focused on the health of women in the military—including longitudinal studies of military women’s health and the design, development, and maintenance of the databases required to support this type of research. As part of this effort, the committee further recommends continued development of both general and gender-specific databases that allow sharing of epidemiologic and other health data across the three services and with other researchers. To ensure continuity and utilization of information contained in comprehensive, large-scale databases on the health of military women, the committee recommends that the responsibility for their development and maintenance be assigned to single entities that would make information available to health facilities and clinicians in all the military services as well as to the research community.

An ongoing research program would enable DoD to take action to correct problems in women’s health and women’s health care that are only beginning to be recognized. With the growing proportion of women in the Armed Forces, such action would support mission readiness, mobilization, and deployment, and would promote women’s health throughout their military careers and beyond. The committee recommends the formation of an ongoing Defense Women’s Health Research advisory group to assist the long-term effort.

RECOMMENDATIONS FOR RESEARCH AREAS

The committee’s recommendations of specific topics for research fall into four broad areas:
1. **Major factors affecting the health and work performance of military women**: Research is needed to address women's physiological, psychological, and behavioral responses to a combination of operational stressors such as extreme ambient temperature, intense physical activity, trauma, fatigue, and restrictive clothing. Women's nutrition; physical fitness; and gynecologic, reproductive, and psychological health must be studied in relation to their effects on performance of military responsibilities. Research is also needed to investigate gender-specific aspects of drug metabolism and action and to reduce limitations posed by protective clothing and equipment designed primarily for males.

2. **Psychological and health issues resulting from integration of women into a hierarchical male environment, or related to women and men living and working together in close quarters**: These issues include but are not limited to sexual harassment or physical abuse and maintaining privacy and self-respect in close quarters. Studies are needed on such topics as the extent and impact of stereotyping of military women, various aspects of physical and sexual assault on military women, response to treatment for traumatized servicewomen, and clothing or equipment to facilitate normal elimination of body wastes.

3. **Health promotion and disease prevention**: This research area covers examination of the scientific basis, usefulness, and results of educational programs targeted to improve or maintain women's health. Among the many important topics are smoking cessation, the prevention of common problems such as vaginitis and urinary tract infections, the prevention of sexually transmitted diseases and unplanned pregnancy, the promotion of long-term bone health, the effectiveness of services' physical training and weight control programs in promoting the maintenance of fitness and body weight within specific standards throughout servicewomen's careers, and the prevalence of disordered eating and its relationship to weight and fitness standards and performance. Various aspects of occupational demands and exposures to potential health hazards (e.g., fuel vapors, electromagnetic radiation, smoke and obscurants, blast, munition residues, repetitive impact shock, prophylactic medications and immunizations, pesticides) need to be examined in relation to their effects, if any, on pregnancy outcomes.

4. **Access to and delivery of health care**: Health services research related to many aspects of the care of women in the military is clearly needed. One important area is the study of mechanisms for providing easy access to confidential, sensitive, high-quality gynecologic and reproductive care to women in field conditions. Possible approaches include the use of specially trained providers and self-care packs. Data about health care concerns and needs, obtained from the women themselves, need to be collected and analyzed. Health services research could also address the value of screening
programs (for pregnancy or sexually transmitted diseases), barriers to the use of mental health services and ways to reduce these barriers, the use of technology in delivering gender-specific care at remote sites (telemedicine), and health care requirements of women in the reserve component.

Recommendations in these four areas are described in more detail in chapter 3 of the report.
Introduction and Overview

LEGISLATIVE BACKGROUND

In recognition of the rapidly growing number of women in the country’s Armed Forces and the unique challenges and stressors faced by these women, the Defense Authorization Act for Fiscal Year 1994 called on the Secretary of Defense to ensure that women and minority group service members are included in all clinical research projects in numbers sufficient to detect gender- or minority group-specific effects. It further authorized the secretary to establish a Defense Women’s Health Research Center for “multidisciplinary and multi-institutional research on women’s health issues related to service in the Armed Forces.” Although the President’s budget submission had not requested funds for such an effort, $40 million dollars was provided in the 1994 Defense Appropriations Act.

The Secretary of Defense submitted an implementation plan to Congress in May 1994, which called for the establishment of a Defense Women’s Health Research Program (DWHRP) rather than a single research center. The plan called for three major types of research: (1) epidemiologic research identifying the nature and scope of women’s health issues relevant to military service, and the construction of centralized databases for this information; (2) research supporting the development of policies and standards related to training, operations, deployment, and retention; and (3) research emphasizing interventions that directly address issues impacting women’s military service.

The U.S. Army was appointed the executive agent to manage the program and to maintain coordination with the other military services and federal agencies, with execution falling to the U.S. Army Medical Research and Development Command. In separate actions, the Command solicited proposals for intramural research at military laboratories and hospitals, and for
extramural research contracts with civilian institutions. The Army, Navy, and Air Force prioritized the submissions from their own facilities (with the Navy responsible for Marine Corps proposals). A tri-service panel of medical scientists then produced an integrated priority list based on program relevance, tri-service application, critical service-unique needs, and near-term benefit to women service members. Extramural proposals underwent contracted peer review by a panel of military, government, and private sector scientists.

Of the $40 million in funds appropriated for FY 1994, $16 million had been awarded to 102 intramural projects (Institute of Medicine, 1995b) and $20 million to 28 extramural projects at the completion of this report. Whereas the extramural projects were multiyear, pre-funded grants of up to four years’ duration, the intramural projects had to be completed in one year.

The Defense Authorization Act for Fiscal Year 1995 directed the Secretary of Defense to continue the Defense Women’s Health Program and authorized a second $40 million (subsequently provided in the 1995 Defense Appropriations Act) for program activities, which it specified would include:

Epidemiologic research regarding women deployed for military operations including research on patterns of illness and injury, environmental and occupational hazards (including exposure to toxins), side-effects of pharmaceuticals used by women so deployed, psychological stress associated with military training, deployment, combat and other traumatic incidents, and other conditions of life, and human factor research regarding women so deployed.

Development of a data base to facilitate long-term research studies on issues related to the health of women in military service, and continued development and support of a women’s health information clearinghouse to serve as an information resource for clinical, research, and policy issues affecting women in the Armed Forces.

Research on policies and standards issues, including research supporting the development of military standards related to training, operations, deployment, and retention and the relationship between such activities and factors affecting women’s health.

Research on interventions having a potential for addressing conditions of military service that affect the health of women in the Armed Forces.

The Command (now renamed the U.S. Army Medical Research and Materiel Command) made several changes in its management of the FY 1995 DWHRP appropriation. Most importantly for the present study, the Institute of Medicine (IOM) was asked to serve as an independent source of advice on priorities for new research initiatives. Overall responsibility for managing the program was shifted to the director of the Command’s Research Area VI, who
also oversees execution of the Army’s congressionally mandated breast cancer research program. A tri-service steering committee was appointed to advise the director. Full competition was mandated for intramural as well as extramural research, with independent nongovernment peer review for both.

SPECIAL CONSIDERATIONS FOR MILITARY WOMEN’S HEALTH NEEDS

The past decade has seen steadily increasing attention to the need to include women in clinical research of all kinds. Congress mandated the inclusion of women in all clinical research projects funded by the National Institutes of Health (NIH) and the Department of Defense (DoD), and offices of women’s health now exist in many federal agencies. One of the first actions taken by the Office of Research on Women’s Health at NIH was to convene a major conference on opportunities in women’s health research. The report of that conference set forth a comprehensive agenda for national research efforts in women’s health (Office of Research on Women’s Health, 1992). Some elements of that agenda have already been addressed in the 14-year, $625 million Women’s Health Initiative at NIH and the greatly enhanced funding for breast cancer research at both NIH and DoD. Nevertheless, as the legislation establishing the DWHRP suggests, women in the military are a special population in many ways and face a host of health issues unlikely to be addressed by a purely civilian research program. The following sections provide a very brief description of these women and some of the challenges they face.

Demographics

In 1995, nearly 200,000 women were on active duty in the Armed Forces—comprising approximately 14 percent of the total (except as indicated, data in this section were provided via personal communications with DoD contacts who reported their source as either their service’s personnel department or the Defense Manpower Data Center). Recruiting projections envision this percentage climbing as high as 20 percent in the near future. Approximately 36 percent of the women were in the Army, 34 percent in the Air Force, 27 percent in the Navy, and 4 percent in the Marine Corps. Across the services, nearly 40 percent of active duty women were classified as belonging to a minority group (31 percent African-American, 5 percent Hispanic, 2.5 percent Asian-American/Pacific Islander, 1.5 percent Native American and other). Minority group members comprise 53 percent of Army women, with African-American women alone accounting for 44 percent.
INTRODUCTION AND OVERVIEW

TABLE 1-1 Number of Active Duty Women in the Four Armed Services by Age Group, February 1995

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<td>2,169</td>
<td>161</td>
<td>3,343</td>
<td>8,512</td>
<td>4.4</td>
</tr>
<tr>
<td>&gt;45</td>
<td>1,090</td>
<td>571</td>
<td>44</td>
<td>729</td>
<td>2,434</td>
<td>1.3</td>
</tr>
<tr>
<td>Total</td>
<td>69,548</td>
<td>52,475</td>
<td>7,753</td>
<td>64,595</td>
<td>194,371</td>
<td>100.0</td>
</tr>
</tbody>
</table>

*May not add to 100 because of rounding.

SOURCE: Defense Manpower Data Center.

Tables 1-1 and 1-2 show the distribution of women by age group and rank. The age distribution is a very skewed one, with women under the age of 26 making up more than half of the population and women over 40 comprising only 6 percent of active duty females. Women are as well represented in the officer ranks (12.8 percent of all officers) as they are in the enlisted (12.5 percent of all enlisted personnel). Less than half of the active duty women are married, compared with two-thirds of the active duty men. Although single parents of either sex are ineligible to join the Armed Forces, a 1990 study of Navy personnel estimated that 11 percent of active duty women (and about 2.6 percent of men) are single parents having one or more dependent children living with them (Thomas and Thomas, 1993).

Figures 1-1 and 1-2 provide some data on the types of jobs held by active duty female officers and enlisted women, respectively. Health care and supply/administration are the dominant occupations, but regardless of primary military occupational specialty, all military women (and men) must be ready to perform their primary tasks and other duties as assigned in conditions seldom experienced by their civilian counterparts (see section “Occupational Demands”).
TABLE 1-2 Rank Distribution of Active Duty Women in the Four Services, February 1995

<table>
<thead>
<tr>
<th>Service</th>
<th>Officers</th>
<th></th>
<th>Enlisted Personnel</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. Female</td>
<td>% Female</td>
<td>No. Female</td>
<td>% Female</td>
</tr>
<tr>
<td>Army</td>
<td>10,256</td>
<td>13.3</td>
<td>59,394</td>
<td>13.4</td>
</tr>
<tr>
<td>Navy</td>
<td>7,754</td>
<td>12.9</td>
<td>44,728</td>
<td>11.7</td>
</tr>
<tr>
<td>Marine Corps</td>
<td>690</td>
<td>3.6</td>
<td>7,588</td>
<td>4.7</td>
</tr>
<tr>
<td>Air Force</td>
<td>12,069</td>
<td>15.3</td>
<td>52,517</td>
<td>15.9</td>
</tr>
<tr>
<td>Department of</td>
<td>30,635</td>
<td>12.8</td>
<td>163,785</td>
<td>12.5</td>
</tr>
</tbody>
</table>

SOURCE: Defense Manpower Data Center.

No description of women in the military would be complete without some consideration of the reserve components. Here, approximately 140,000 women constitute an even higher proportion of the force (16 percent) than their active duty counterparts. The Persian Gulf War showed how heavily the U.S. Armed Forces depend on reserve components to conduct large-scale military operations. Twenty percent of the force deployed to the Gulf was from the reserves, and certain wartime tasks were performed entirely by individuals and units from the reserve forces.

Health-related Requirements

Women in the military are a select population in additional ways: (1) they are a generally healthy population since they must meet a number of criteria to enter and remain in the military; and (2) all active duty personnel (and reserves, when actually on duty) receive a wide array of health services, including prescription medications, at no cost. As noted below, many of these health services are mandatory.

To enter the Armed Forces, the individual (with few exceptions, a 17- to 35-year-old with at least a high school diploma and no record of serious legal problems) must be free of contagious diseases that would be likely to endanger the health of other personnel, and free of chronic diseases, medical conditions, or physical disabilities that would preclude satisfactory completion of the required training, result in excessive time lost from duty, or put geographic limits on deployment.
FIGURE 1-1 Primary occupations of active duty women officers. SOURCE: Adapted from Military Women in the Department of Defense.

A complete physical examination is required every five years (more often after the age of 40) and provided to both active and reserve personnel. If a service member develops a debilitating medical, physical, or mental condition while in the service, the need for restricted duty or discharge is decided on an individual basis by a standing panel of physicians. Thus, although a person with any form of diabetes mellitus, for example, would be ineligible to enter the Armed Forces, one who develops the condition while in the service might be retained on active duty but be restricted to assignments in which a reliable supply of insulin and the means for storing it are readily available.

All service members (reserve as well as active component) are evaluated at scheduled intervals (once or twice yearly at a minimum) for compliance with weight and fitness standards established by their service. The weight standards are gender- and height-specific, while the fitness standards are gender- and age-specific. All four services assess cardiorespiratory endurance, and the Army, Navy, and Marine Corps also test strength and flexibility. A 25-year-old Army woman, for example, must perform 16 push-ups in 2 minutes, 45 situps in 2 minutes, and run 2 miles in less than 19 minutes 36 seconds, with no more than 10 minutes rest between the three component “events.”
Revised failure to meet either weight or fitness standards results in remedial action (supervised dieting and/or exercise) and may ultimately lead to discharge.

Health Services Provided

By policy, both active duty service members and reservists are required to participate in health maintenance programs that include the following:

1. Services provided to active duty women by military medical facilities (reservists must provide documentation from a private physician):

   - annual Pap smears;
   - breast examinations; and
   - a baseline mammogram if over age 40, routine updates thereafter, and yearly mammograms after age 50;

2. Services provided to all as necessary by military medical facilities:
INTRODUCTION AND OVERVIEW

- annual screening for human immunodeficiency virus and cholesterol;
- routine immunizations, annual influenza immunizations, immunization against hepatitis B if at risk because of medical responsibilities, and immunizations specific to overseas deployment; and
- random urine testing for drugs of abuse.

Counseling on family planning and contraception (and appropriate means) is offered during the annual appointment for breast examination and Pap smear, and every visit to a health care facility includes a blood pressure check and advice or referral as indicated. Brief questionnaires on smoking, drinking, and diet (Health Risk Appraisal) are also administered at least annually and used for counseling.

Health Behaviors of Military Personnel

The 1992 Worldwide Survey of Substance Abuse and Health Behaviors Among Military Personnel (Bray et al., 1992) asked a sample of more than 16,000 active duty service members a wide range of questions concerning their health. Unfortunately, no comparable data are available for reservists. Some of the data of special import for women’s health research are summarized here. In some cases the data are not available by gender.

- More than 50 percent of all active duty service members engaged in strenuous physical activity for 20 minutes or more at least three days per week in the month preceding the survey.
- Only 9 percent of all military personnel reported being identified as overweight in the previous year.
- Nearly 100 percent of active duty women reported having a Pap smear within the past 12 months.
- Approximately 66 percent of service members recalled having their blood pressure checked in the past year, and 90 percent of those identified with hypertension were taking action to control their blood pressure.
- About 36 percent of service members recalled having their cholesterol level checked in the past year.
- Approximately 50 percent of all unmarried military individuals reported using a condom during their last sexual intercourse.
- Only 6.2 percent of DoD personnel surveyed reported illicit drug use in the previous 12 months.

Although smoking is currently banned in all DoD facilities, and all of the services offer educational and smoking cessation programs, 31 percent of
active duty females smoke, far above the Healthy People 2000 goal of 20 percent or less, and more than 17 percent are heavy smokers (one pack or more of cigarettes daily). Among civilian women, heavy smoking is less common (12 percent).

Similarly, although DoD offers health promotion and safety education programs to emphasize responsible alcohol use, 4.4 percent of female survey respondents reported heavy drinking (five or more drinks on at least one occasion per week), compared with the 3.5 percent of civilian women reported by the National Household Survey on Drug Abuse (National Institute on Drug Abuse, 1991). Of military women, 30 percent are nondrinkers—far below the proportion of abstainers among civilian women (47 percent).

A substantial number of planned and unplanned pregnancies occur in this young, healthy, fit population. Point-in-time self-report data from the Navy (Thomas and Edwards, 1989; Thomas and Thomas, 1993) have consistently shown about 8 to 9 percent of enlisted women pregnant. Navy hospital records (Calderon, 1994) on the annual number of pregnancies yield about the same 8 to 9 percent when divided by the average number of active duty Navy females. Women under age 25 accounted for almost two-thirds of pregnancies (65 percent of the total in the 1992 survey). Like their civilian counterparts (Forrest, 1994), more than half of these younger servicewomen reported that the pregnancy was unplanned, although 56 percent of those reporting an unplanned pregnancy also reported they had been using birth control, most commonly condoms or the pill.

Another frequent consequence of sex is sexually transmitted disease (STD). Preliminary results from a large-scale survey of active duty Army personnel show 18 percent of women respondents reporting at least one STD over a two-year period (Jenkins and Nannis, 1995).

**Occupational Demands**

Despite the advantages of being a young, healthy, fit population, military women (and their health care providers) face many challenges not generally encountered by their civilian peers. Depending on their assignment, military women may be exposed to any combination of the following conditions or situations that pose physical and psychological threats.

All military personnel initially experience the physical challenges of basic training, which may be extreme, depending on their initial fitness level. Stress fractures and other overuse injuries are common, especially among female recruits (Jones et al., 1993; Pester and Smith, 1992; Ross and Woodward, 1994). Heat injuries are a danger for much of the year, given the location of current basic training sites. Psychological stress (fear of injury or fear of failure) is introduced deliberately as part of the training, and absence from
duty, even for good medical reasons, may mean a repetition of some or all of basic training. These experiences occur far from home, friends, and family—the traditional sources of advice, encouragement, and help in difficult times.

Once through basic training, the new soldier, sailor, marine, or airman [sic] is again separated from now familiar sources of social support and faced with learning the specifics of a military specialty, often involving equipment and procedures that evolved in a completely male work force. Risk of injury is always elevated for the novice—a risk driven higher for women when clothing, equipment, tools, protective gear, and prescribed methods have been designed for men.

Deployment—whether for training, humanitarian purposes, peacekeeping missions, or combat operations—impacts on health care in a host of ways. Austere conditions are the rule, whether at field training sites in the United States, on board ships at sea, or in improvised base camps in a foreign country (U.S. General Accounting Office, 1993). Geography and weather are frequently harsh—troops arriving in Saudi Arabia at the start of the prewar buildup stepped off the plane into 125°F heat. Housing and sanitary facilities are often primitive—many Gulf War soldiers slept elbow to elbow in warehouses or tents for weeks before the war began, sharing outdoor cold water showers and hastily built plywood outhouses. Some were required to subsist for extended periods (30 to 60 days) on combat rations that were designed and tested almost exclusively with male soldiers. Once the war began, they slept in their vehicles, dug slit trench latrines, and had little or no access to shower facilities. Because transportation is critical, space and thus supplies are limited. "Bullets, beans, and bandages" are the traditional priorities, but medical care is limited by both the dispersion of troops (or ships) and by the necessity for compact, mobile facilities.

Deployment may also entail exposure to some diseases that are unfamiliar to most Americans. Leishmaniasis, a parasitic disease commonly found in the subtropics and tropics, is an example from the Persian Gulf War. Prophylactic medications (e.g., mefloquine or doxycycline in locations where malaria is endemic) and immunizations help protect American troops against many diseases endemic to overseas areas, and also against potential agents of biological warfare such as anthrax. The recent outbreak of Ebola virus in Zaire, however, illustrates the potential for unknown dangers. Each new medication and vaccine also presents a small but measurable risk of adverse effects.

Repeal of the Combat Exclusion Law opened up many dangerous jobs to women. Women are now flying combat aircraft and serving on combat ships from aircraft carriers to destroyers. Although still excluded from direct ground combat units in the Army and Marine Corps, women in combat support units will be close enough to the front lines to be endangered by enemy artillery, aircraft, SCUD missiles, and other indirect fire. Protection against chemical
warfare agents may involve prophylactic "pretreatment" with drugs such as pyridostigmine (a medication that counteracts the effects of organophosphate "nerve gas") for weeks at a time. Copious use of fuels and lubricants (with attendant exhaust), pesticides, and insecticides adds to dust and smoke as potential health hazards. As the controversy over "Persian Gulf Syndrome" shows, the danger to men, women, and fetuses from exposure to these substances, alone or in combination, is still not clear (National Institutes of Technology Assessment Workshop Panel, 1994; U.S. General Accounting Office, 1994; Institute of Medicine, 1995). Electromagnetic radiation (from laser range finders and target designators; radio-frequency, microwave, and millimeter-wave communications; and electronic warfare equipment) represents another potential military health hazard, in or out of combat environments.

Combat stress reactions and post-traumatic stress disorder (PTSD) have been major sources of morbidity in and after past conflicts. Military doctrine now recognizes that psychological symptoms are an expected consequence of witnessing or participating in the horrors of war. Much less is known about possible gender differences in the nature, intensity, and optimal treatment of such responses to stress (Baum and Grunberg, 1991; Wolfe et al., 1993).

Other psychological health issues arise from the necessity of sharing close quarters with largely male peers for extended periods. In a recent Navy study of sexual harassment (Culbertson and Rosenfeld, 1994), 44 percent of 6,300 enlisted women surveyed in 1991 reported that they had been sexually harassed during the previous 12 months. More than half of those harassed reported that they had developed symptoms such as headaches, difficulty sleeping, or nausea. As a result, 7 percent went on sick call, and 16 percent took unplanned leave, accounting for some 450,000 hours away from work.

**SUMMARY**

By necessity, the foregoing material represents only a brief sketch of some of the special considerations in the analysis of military women's health needs. However, it demonstrates the rationale behind congressional concern for the health of women service members, illustrates some reasons why research is needed specifically for military women, and provides an overview of some of the issues that the IOM committee considered when starting to analyze what that research should include.
REFERENCES


Methods

The committee process involved extensive information gathering; examination of citations, abstracts, and other findings; and deliberations that directed this acquisition of information and were informed in part by those findings. Recommendations are based on the collective opinion of the expert committee. Information gathering and search results are described below.

INFORMATION GATHERING

To provide a partial basis for recommendations, the committee examined results from extensive online searches of the published research literature relevant to the health of military women. To avoid making recommendations that would duplicate ongoing research, information gathering also included (1) extensive searching of current research databases; (2) contacting federal agencies and offices; and (3) contacting representatives of the Army, Navy, and Air Force. Research pertaining to breast cancer was purposely omitted, since it is the subject of a separate Department of Defense (DoD) research program. The committee advised project staff on general parameters for information gathering. Each of four working groups (clinical, occupational/environmental, physiological, and psychosocial) provided detailed guidance concerning databases, search strategies, and other aspects of data retrieval.
TABLE 2-1 Online Databases Searched

**Bibliographic Databases**
Agricola
Dissertation Abstracts
EMBASE
ERIC (Educational Resources Information Center)
Health Services/Technology Assessment Research (HSTAR)
Medline
National Technical Information Service (NTIS)
Occupational Safety and Health
PsycInfo
Social SciSearch
Sociological Abstracts
SpaceLine (in development by the National Library of Medicine)
Sport
Textile Technology Digest
Toxline

**Current Research Databases**
CRIS/USDA (Current Research Information System)
Federal Research in Progress
Work Unit (on the Defense RDT&E® Online System)

*Research, Development, Testing, and Evaluation.*

**Online Databases**

Eighteen databases covering scientific research were accessed using Dialog, a commercial database vendor; the National Library of Medicine’s (NLM’s) Medical Literature Analysis and Retrieval System (MEDLARS); and the Defense Technical Information Center’s Defense Research, Development, Testing, and Evaluation Online System (DROLS) (Table 2-1). Although there is subject and content overlap, each database searched serves a unique function, has a distinct subject emphasis that is relevant to the study, and indexes information not available elsewhere.

The committee judged that a search of citations from 1985 through the present (May 1995) would provide adequate coverage of completed research on women.

With ongoing input from committee members, the Institute of Medicine (IOM) staff used a series of search strategies (see Institute of Medicine, 1995). When available, database thesauri, including the Medical Subject Headings
(MeSH) thesaurus for Medline, were used to locate specific terms that would maximize retrieval. Free text searching was also used. When possible gaps in the research were identified and search strategies were reexamined and expanded as appropriate to determine whether those gaps were real.

Preliminary searches of the published literature were quite broad in terms of the study populations. Military personnel, working women, female athletes, or gender differences were among the possible options. After examination of preliminary search results, the committee narrowed most searches of the published literature to military personnel or military women (see Table 2-2). Searches of current research were conducted for women, generally excluding elderly women.

The broad scope of the searching resulted in retrieval of more than 5,700 citations of published works and 2,600 citations for current research. All of these citations were converted into a new format for inclusion in either the bibliographic or the current research database. Citations that were obviously not relevant to the study were deleted by project staff.

Staff implemented an indexing scheme to organize the citations for convenient use by appropriate committee members and searched the new databases in many ways. Committee members received a set of citations and abstracts for their assigned areas. Supplementary topical bibliographies with abstracts were distributed periodically. Committee members identified citations that were to be deleted because of lack of relevance to military women’s health research.

At the conclusion of the study, the database covering published works contained more than 2,100 references to relevant research on women’s health, and the database covering current research contained more than 1,100 references.

**Other Information Sources**

Project staff contacted a number of other information sources: Department of Defense personnel, federal offices and agencies (Table 2-3), the Defense Advisory Committee on Women in the Services (DACOWITS), and publications on the status of women’s health in the U.S. civilian population. Background documents and listings of current studies were received from many of the contact persons. These materials were reviewed by staff and committee members for relevance to the study. In addition, the committee reviewed a copy of the interim report of the Institute for the Advancement of Social Work Research (IASWR), Defense Women’s Health Research Program (DWHRP), Strategic Planning Committee. The IASWR committee developed
<table>
<thead>
<tr>
<th>Search Terms</th>
<th>Search Population</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Military Women</td>
</tr>
<tr>
<td><strong>Psychological/Psychosocial</strong></td>
<td></td>
</tr>
<tr>
<td>Post-traumatic stress disorder or PTSD or psychological stress or psychophysiological disorders</td>
<td>X</td>
</tr>
<tr>
<td>Substance abuse or drug abuse or alcohol abuse or tobacco or depression or suicide</td>
<td>X</td>
</tr>
<tr>
<td>Family issues or separation or isolation or combat or single parent</td>
<td>X</td>
</tr>
<tr>
<td>Violence or rape or sexual assault or sexual harassment or child abuse</td>
<td>X</td>
</tr>
<tr>
<td>Job stress or training stress or readiness or retention or job satisfaction or job readiness or deployment</td>
<td>X</td>
</tr>
<tr>
<td>Social support or community resource or unit support</td>
<td>X</td>
</tr>
<tr>
<td><strong>Occupational/Environmental</strong></td>
<td></td>
</tr>
<tr>
<td>Occupational exposure or occupational health or hazardous substances or occupational diseases</td>
<td>X</td>
</tr>
<tr>
<td>Category</td>
<td>X</td>
</tr>
<tr>
<td>-------------------------------------------------------------------------</td>
<td>---</td>
</tr>
<tr>
<td>Neurotoxicity or reproductive toxicity or immunotoxicity or hepatotoxicity or respiratory toxicity or cardiovascular toxicity or dermatoxity or nephrotoxicity</td>
<td>X</td>
</tr>
<tr>
<td>Organophosphates or oil fumes or pollutants or air pollution or radiation or electromagnetic fields or pesticides or insecticides</td>
<td>X</td>
</tr>
<tr>
<td>Viruses or bacteria or protozoa or fungi or infectious agents or biologicals or communicable diseases or infectious diseases</td>
<td>X</td>
</tr>
<tr>
<td>Protective devices or protective clothing or thermal properties</td>
<td>X</td>
</tr>
<tr>
<td>Hyperbaric pressure or hypobaric pressure</td>
<td>X</td>
</tr>
<tr>
<td>Anthropometry or weight bearing or load bearing or equipment design or biomechanics</td>
<td>X</td>
</tr>
<tr>
<td>Athletic injuries or fractures or sprains or strains or musculoskeletal injuries</td>
<td>X</td>
</tr>
</tbody>
</table>

**Clinical**

<table>
<thead>
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<th>Category</th>
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</thead>
<tbody>
<tr>
<td>Blood pressure or cardiovascular diseases or cholesterol or headache or migraine or breast diseases or mammograms or pulmonary diseases or respiratory diseases or immune complex diseases or skin diseases or hearing disorders or hearing loss or auditory loss or vision disorders or neuromuscular diseases or digestive system diseases</td>
<td>X</td>
</tr>
</tbody>
</table>

Continued
<table>
<thead>
<tr>
<th>Search Terms</th>
<th>Search Population</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Clinical continued</strong></td>
<td></td>
</tr>
<tr>
<td>Sexually transmitted diseases or vaginitis or cystitis or urinary tract</td>
<td>X</td>
</tr>
<tr>
<td>infections or urinary incontinence or fecal incontinence or bladder</td>
<td></td>
</tr>
<tr>
<td>prolapse or pelvic prolapse or procidentia or cystocele or rectocele or</td>
<td></td>
</tr>
<tr>
<td>musculoskeletal diseases or otorhinolaryngologic diseases</td>
<td></td>
</tr>
<tr>
<td>Menstrual cycle or menstruation or menstrual disorders or contraceptive</td>
<td>X</td>
</tr>
<tr>
<td>agents or birth control or fetus or fetal or pregnancy or pregnancy</td>
<td>X</td>
</tr>
<tr>
<td>complications or infant or fertility or postpartum or puerperium or lactation</td>
<td></td>
</tr>
<tr>
<td>or lactation disorders or breast feeding or infertility or gynecological</td>
<td></td>
</tr>
<tr>
<td>disorders</td>
<td></td>
</tr>
<tr>
<td>Rheumatology or arthritis or bursitis</td>
<td>X</td>
</tr>
<tr>
<td>Telemedicine or health needs or health status or delivery of health</td>
<td></td>
</tr>
<tr>
<td>care or health care services</td>
<td>X</td>
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</tbody>
</table>
Physiological

Biological products or anthelmintics or antidiarrheals or anti-inflammatory agents or antidotes or antibiotics or contraceptive agents or anesthetics or bronchodilator agents or antihistamines or analgesics or estrogen replacement therapy or altitude sickness-drug therapy or vaccines or vaccination or antihypertensive agents or motion sickness-drug therapy or pharmacokinetics or pharmacodynamics or drug metabolism

<table>
<thead>
<tr>
<th></th>
<th>X</th>
<th>X</th>
</tr>
</thead>
</table>

Physical fitness or muscle contraction or muscles-physiology or exercise or psychomotor performance or bone density or arm-physiology or pectoralis muscles or upper body strength

<table>
<thead>
<tr>
<th></th>
<th>X</th>
<th>X</th>
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Resistance training or weight training or weight lifting or postpartum fitness

<table>
<thead>
<tr>
<th></th>
<th>X</th>
<th>X</th>
</tr>
</thead>
</table>

Nutrition assessment or nutritional status or nutritional requirements or caloric intake or eating disorders

<table>
<thead>
<tr>
<th></th>
<th>X</th>
<th>X</th>
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</thead>
</table>

Vitamins or antioxidants or substrate utilization or glucose utilization or free fatty acids or nutritional supplements or calcium or iron or gastrointestinal absorption or immune function or renal function or reaction time or athlete triad or female triad

<table>
<thead>
<tr>
<th></th>
<th>X</th>
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Continued
**TABLE 2-2 Continued**

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<thead>
<tr>
<th>Search Terms</th>
<th>Military</th>
<th>All Military</th>
<th>Gender Differences</th>
<th>Women Athletes</th>
<th>Other Occupations</th>
</tr>
</thead>
</table>

**Physiological continued**

- Heat-adverse effects or cold-adverse effects or hypothermia or humidity or food deprivation or hunger or water deprivation or thirst or fatigue or body temperature regulation or sleep deprivation or noise or sensory thresholds or water electrolyte imbalance or vasoconstriction or altitude or work capacity evaluation or heat exhaustion or exertion or acceleration or stress-physiological or circadian rhythm or jet lag

- Body weight or adipose tissue or body mass index or skinfold thickness or obesity or body composition or body fat or fat distribution or densitometry or body weight standards

- Circadian rhythm or jet lag

- Dark adaptation or sunlight or luminescence or ultraviolet light or lasers

---

**NOTE:** This is a list of the primary terms used. Some terms were truncated or proximity searched to maximize retrieval. When available, database hierarchical structures were utilized (e.g., MeSH tree structures) to retrieve subordinate terms.

*aFor more information, see Institute of Medicine, 1995.*
recommendations for the inclusion of psychosocial research within a broadly defined investment strategy for the DWHRP.

Of special interest was information provided by DACOWITS. This committee of nonfederal government civilian women and men, which serves without remuneration, "... assist[s] and advise[s] the Secretary of Defense on policies and matters relating to women in the Military Services. In its advisory capacity, DACOWITS recommends measures to ensure the effective utilization of women in the Armed Forces" (U.S. Department of Defense, 1995). It develops its recommendations from formal testimony at periodic meetings and from confidential interviews with servicewomen during visits to installations across the United States and overseas. Some of the topics it addresses are related to women's health, and many DACOWITS recommendations provided perspectives that the committee considered during its deliberations.

Representatives of the Armed Forces provided several kinds of information for the committee's review:

- listings of current intramural and extramural projects funded through the DWHRP;
• reports covering other major military programs in health-related research;
• listings of clinical protocols and the clinical investigation programs of military hospitals; and
• selected demographic and health status data concerning military women (not all requested information was available).

Seventeen military and civilian representatives of the Armed Forces gave presentations to the committee and responded to immediate and postmeeting questions. Committee members also obtained anecdotal information informally from a small number of servicewomen.

SEARCH RESULTS

Published and Current Studies

Listings of relevant research results are available in electronic and published form (Institute of Medicine, 1995).1 These include a bibliographic listing of relevant search results from the published literature, organized by topic areas that the committee judged to be especially important, and a similar listing of research in progress. Of special note is the list of the intramural and extramural research funded with FY 1994 appropriations by DWHRP.2 Any studies that had not been entered in the Federal Research in Progress, Current Research Information Service, or Work Unit databases or that had not been provided by the sponsoring agency were unavailable for review by the committee and are therefore missing from these listings.

For both published and current research, citations were generally omitted if they covered health care problems that make servicewomen ineligible for deployment. Examples include chronic obstructive pulmonary disease, myocardial infarction, human immunodeficiency virus (HIV) infection, and diabetes mellitus. Many studies that dealt with the prevention of chronic diseases were included.

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1For ordering information, see the verso title page of this book.
2Information about extramural research awards was not public when Recommendations for Research on the Health of Military Women: Bibliographies went to press.
METHOIDS

Limitations of the Review of Published and Current Studies

Having access only to citations and abstracts (and in some cases citations only), committee members did not attempt to assess the quality of the published or current studies. Moreover, committee members did not attempt to explore all aspects of a specific topic as would be done if they were preparing a research proposal in a specified area. Rather, they looked for information about a number of factors, including the following:

- the number of studies in an area;
- the range of studies that addressed the topic;
- the approaches used in addressing the topic;
- the extent to which women had been used as participants and results analyzed separately;
- the extent to which ethnic background was considered;
- whether the phase of the menstrual cycle was considered, if applicable;
- military relevance if not conducted with military subjects; and
- applicability to U.S. women if study participants were from other countries.

The bibliographies include some studies that are overtly flawed or that committee members considered might be seriously flawed (Institute of Medicine, 1995). The committee includes them because they are a part of the information processed. No indications of quality are to be assumed.

Uses for Listings of Published and Current Studies

Potential investigators, current investigators, and Armed Forces practitioners can all benefit from the listings of published works and the listings of research in progress (Institute of Medicine, 1995). Because of the large number of databases searched, these listings include studies that might be missed by routine searching and that might provide leads for other searches. The topical bibliographic listings provide a convenient starting point for a targeted, critical review of the literature. The topical listings of current research can stimulate communication among investigators with related interests. Review of the combination of published works and work in progress can suggest further aspects of research that have been ignored or require more attention.
Other Types of Information

Material from DACOWITS

The committee identified several recurrent, relevant recommendations in the materials from DACOWITS: 3

- actions to improve the quality, availability, and affordability of child care;
- strict enforcement of a zero-tolerance policy of sexual harassment in the services and service academies, and systems to ensure its implementation;
- assessment of the need for routine obstetric and gynecologic care for servicewomen, especially those at foreign or isolated locations, and follow-up to ensure that these needs are met; and
- extension of opportunities to women in terms of positions and training.

The following concerns were among those identified during the 1994 fall DACOWITS conference visits to installations or in the special presentation for this study:

- methods of addressing women’s health care that do not set women apart from men;
- various effects of unplanned pregnancies on the individual, military women, and the unit;
- various aspects of weight and physical training standards, with specific concern about disordered eating;
  - fit of uniforms, boots, and masks;
  - avoidance of artificial separations for the women (e.g., overconcern for special female facilities);
- methods to ensure equitable assignment to leadership, training, and career development; and
- access to the type of health care sought.

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3 Excerpts from “Recommendations from Defense Advisory Committee on Women in the Services (DACOWITS),” a compilation presented to the Committee on Defense Women’s Health Research. Entries were from fall 1968 through fall 1994, with some gaps in the early years.
METHODS

Military Health-related Databases

Military medical researchers provided an overview of databases and other sources of health information about women in the military. The first issue (April 1995) of *Medical Surveillance Monthly Report* (MSMR), an Army publication, was made available to the committee. This publication includes gender-specific data about “notifiable conditions” (including the environmental injuries of heat and cold exposure and carbon monoxide intoxication), active duty hospital sick days by diagnostic category, and notifiable sexually transmitted diseases.

*MSMR* draws on several major data sources:

- The Individual Patient Data System (IPDS) collects information about all hospitalizations in Army medical facilities. The Navy and Air Force use the same software to collect data from their hospitals and clinics. These databases are concerned solely with inpatients. The data from the three services are apparently not pooled (John F. Brundage, U.S. Army Center for Health Promotion and Preventive Medicine [USACHPPM], personal communication, 1995), but all are archived at the Defense Manpower Data Center in Monterey, California.

- The Army Disability Agency maintains a database on every person leaving the Army with a medical disability. This is a primarily a legal/financial document and is not routinely open to researchers.

- An extensive database on HIV-related research, including epidemiology and natural histories of HIV-positive service members. (Patient confidentiality is, of course, a major consideration in the use of the latter data, since the numbers are relatively small.)

- The Automated Central Tumor Registry. Every tumor diagnosed in an Army laboratory is automatically entered into this database.

Currently, ambulatory data are not available for research on issues of everyday importance to women’s health. There is no system that collects outpatient data in the same fashion as the IPDS does for in-patients. The preventive medicine services at all Army facilities provide reports of “notifiable conditions” to USACHPPM. All but four of the facilities provide the data electronically. The Navy and Air Force have similar systems, but provide only paper reports. No other outpatient data are aggregated above the individual hospital level, despite the fact that most (if not all) Defense Department medical facilities employ a computer system called the Composite Health Care System (CHCS) to facilitate the efficient delivery of outpatient care. In effect, the CHCS was designed and is used to make clinical operations as paperless as possible; it handles prescriptions, laboratory results, radiology
consults, and referrals, among other things. A standardized computerized ambulatory data record is being developed. Although envisioned as a management tool, this data record may ultimately prove useful for research and development activities.

A number of databases are currently in the development stage with 1994 funding from the Defense Women’s Health Program (see Institute of Medicine, 1995). These include a tri-service relational database to allow timely sharing of data about the incidence of illness and injury in military women among the services; a relational database, consultation, and decision-aiding system; and a database covering health issues for women aboard Navy vessels. In addition, a number of projects have been funded to survey military women concerning various aspects of their health and health care.

SUMMARY

In the short period available, the committee examined the results of extensive online database searches and other kinds of information related to the health and performance of military women. The results of the information-gathering process documented a lack of easily accessible comprehensive information about the health of these women. These results also revealed that the Defense Women’s Health Research Program’s first year of operation has initiated important research targeted to the health of military women, including steps to help define their health status and problems. Above all, the research findings provided an empirical guide to the committee’s attempts to identify strengths and gaps in defense women’s health research.

REFERENCES

Conclusions and Recommendations

Research undertaken to promote and sustain the physical and mental health of military women—both active duty and reserve—holds great promise for contributing to the military services’ readiness and operational effectiveness. Moreover, the Department of Defense (DoD) affords an unrivaled opportunity to conduct research on women's health and health services because of the large number of women from different racial and ethnic groups who meet similar criteria and for whom there are similar records. The committee applauds the focus on women's health and the tri-service approach that are integral aspects of the Defense Women’s Health Research Program (DWHRP).

CONCLUSIONS

Based on its broad search of bibliographic databases and other information sources, as well as its extensive deliberations, the committee affirms the importance of basic elements of DWHRP: epidemiologic research concerning the health of deployed military women, development of one or more databases to facilitate long-term research in this area, and development and support of a military women’s health information clearinghouse (see chapter 1). There is clearly a need for research relating to military women's health issues, but there are also barriers to accessing data that have been collected, and the dissemination of research results has been limited. Some excellent military reports have had little dissemination beyond the military. Assuming that the experience of this committee is typical, the availability and accessibility of information need to be improved. Availability and accessibility of relevant data, including
ambulatory data on issues of everyday importance to women’s health, are crucial to future planning for research.

The bibliographies prepared by the committee (Institute of Medicine, 1995) list published and current research that may be relevant to the health of military women. To keep the number of references manageable, published works have been limited almost entirely to those dealing with military personnel or female athletes. Many studies are from DoD health research programs that have used servicemen as subjects and provide useful information about specific topics, but the results are not necessarily transferable to servicewomen. Similarly, studies of female athletes may be informative but not directly applicable to military women. The listings of current relevant studies includes many that are funded by the National Institutes of Health, U.S. Department of Agriculture, or other civilian sources. Strong research programs are under way in a number of areas of women’s health (e.g., sexually transmitted diseases including human immunodeficiency virus (HIV) infection, other genitourinary conditions, birth control methods, hormone replacement therapy, and the prevention of cardiovascular disease and osteoporosis). The committee concluded, however, that the active civilian research program needs to be complemented by the DWHRP. Unique features and requirements of life in the military warrant special consideration in studies of military women.

The listings of current intramural projects funded by DWHRP (Institute of Medicine, 1995), show that the program has begun to delineate health concerns of military women and to address a number of important concerns. These include but are not limited to chemoprophylaxis, exercise-induced incontinence, a variety of aspects of strength training and testing, effects of nutrition on immune status, and responses of women to a variety of stressors.

**OVERARCHING RECOMMENDATIONS**

**Funding Priorities**

The committee recognizes that research questions concerning military women’s health far exceed current and future fiscal resources. Therefore, it is necessary to establish priorities to ensure the maximum utility of and return on DoD women’s health research investments. Scientific rigor and the expertise of the investigators to conduct, complete, and disseminate research findings are baseline requirements for the consideration of DWHRP research proposals. Failure to meet these basic standards should disqualify proposals from further funding consideration. Basic, applied, and health services research are all acceptable if targeted appropriately.
CONCLUSIONS AND RECOMMENDATIONS

The committee recommends that the following criteria be applied in setting priorities for those proposals that meet basic funding considerations: the research problem or question should be (1) unique to military women (e.g., a study of the potential reproductive toxicity of chemical weapons or medications used to counter them); (2) especially prevalent among military women (e.g., a study of rapid diagnosis and treatment of sexually transmitted disease); or (3) related to the capacity or limitation of military women to perform their mission responsibilities (e.g., a study of the effect of pre-military abuse on psychological response to violence and trauma). The term “military women” applies to both active duty servicewomen and women in the reserve component. However, depending on the research question, the use of civilians or animals as subjects may be appropriate.

The committee recognizes the unusually large proportion of servicewomen from minority racial and ethnic groups and the relative homogeneity of educational background and current economic status of servicewomen of comparable rank. It strongly urges researchers to go beyond the statutory requirement for analysis of clinical research by gender and minority subgroup (Defense Authorization Act for Fiscal Year 1994) and to actively promote studies that provide useful information about relationships, if any, between group membership and the health and performance of women in the military.

Peer Review

To ensure maximum return for DoD’s fiscal investment in women’s health research, the following criteria are proposed for both intramural and extramural research. Each proposal must meet the same requirements and go through peer review.

Administration

Each peer review chairperson should be a nationally recognized scientist with expertise in the field of review. This chairperson should have previous experience with national peer review processes, including the appropriate inclusion of women and minorities in clinical studies as directed by Congress.

Composition of the Peer Review Panel

Each panel should comprise members representing expertise in each of the fields of review. Panel members should represent multiple disciplines and a
wide variety of scientific, teaching, professional, and military experiences. These members should be diversified in terms of their gender and racial or ethnic backgrounds. In addition, panels should have active duty female service members with varied military experiences, whose role would be to provide the consumer's perspective and provide insight regarding health issues of importance to military women. Explicit steps should be taken to preclude personal and professional conflicts of interest.

**Procedures**

The peer review process should be consistent with that used by bodies such as the National Institutes of Health and the National Science Foundation. Primary and secondary levels of review should be employed when large numbers of proposals are received to ensure maximum consideration and optimal deliberation for decision making.

**Military-Civilian Interactions**

The committee recognizes the unique military perspectives, experiences, and resources afforded by DoD intramural research programs. To add breadth and depth and expand dissemination, the committee recommends that DoD intramural efforts increase the formation of strong collaborative partnerships with established academic institutions, federal agencies, or civilian research programs. Furthermore, the committee urges the Command to require that intramural as well as extramural DWHRP awardees document and share their research by submitting manuscripts for publication in scientific, peer-reviewed journals.

Strategies to promote information exchange that can lead to collaboration include jointly sponsoring workshops and seminars, preparing applicant information packets, encouraging civilian scientists to explore opportunities for collaboration by visiting military laboratories (perhaps in conjunction with a workshop or symposium), awarding small grants explicitly to promote collaboration with outside investigators and their access to military populations, publicizing information about the databases managed by the Defense Technical Information Center, providing easy access to the bibliographies and abstracts used in the preparation of this report, and continuing development of the military women's health information clearinghouse.

The committee further recommends continued development of databases for sharing epidemiologic and other health data across the three services and with other researchers.
CONCLUSIONS AND RECOMMENDATIONS

The committee points out that military women themselves are a key source of information and insights of investigators, and they should be involved in identifying their health concerns and investigating the solutions.

RECOMMENDATION FOR LONG-TERM RESEARCH
ON THE HEALTH OF MILITARY WOMEN

Recognizing the historical underrepresentation of women in research projects that address the health and performance of service members, the committee recommends that DoD make a long-term commitment to research focused on the health of women in the military—including longitudinal study of military women and the design, development, and maintenance of databases needed to support this type of research. Among promising topics for longitudinal research are relationships between the aging process and physical skills required in the military; risk factors for osteoporosis and measures for its prevention; relationships among weight, physical activity, and joint disease; relationships between occupational exposures and cancer; and occupational stress in relation to cardiovascular disease or psychiatric sequelae such as post-traumatic stress disorder (PTSD). As part of this long-term research effort, the committee further recommends continued development of both general and gender-specific databases that allow sharing of epidemiologic and other health data across the three services and with other researchers.

Databases and the military women’s health clearinghouse that are under development will require ongoing support to provide a return on investment. To ensure continuity and utilization of the valuable and unique information contained in comprehensive, large-scale databases on the health of military women, the committee recommends that the responsibility for their development and maintenance be assigned to single entities that would provide information to health facilities and clinicians in all the military services as well as to the research community.

An ongoing program would enable DoD to take action to correct problems in women’s health and women’s health care that are only beginning to be recognized. With the growing proportion of women in the Armed Forces, such action would support mission readiness, mobilization, and deployment, and would promote women’s health throughout their military careers and beyond.

To assist the long-term effort, the committee recommends the formation of an ongoing Defense Women’s Health Research advisory group. This should be an independent, nongovernmental group that comprises (1) civilian experts in disciplines related to the health of military women and the types of research needed and (2) two active duty servicewomen (with representatives from both enlisted and officer ranks) who are not connected with any military health research programs. With input from representatives of military laboratories at
scheduled meetings or workshops, this group could perform the following functions:

- monitor and review progress of DWHRP;
- advise about research areas needing increased attention;
- advise about ways to strengthen DWHRP;
- respond to proposed approaches for studying particular health problems of military women; and
- advise about the conduct of research or the interpretation of results from selected studies.

RECOMMENDATIONS FOR RESEARCH AREAS

The committee’s recommendations of specific topics of research fall into four broad areas:

1. major factors affecting the health or work performance of military women;
2. psychological and health issues resulting from integration of women into a hierarchical male environment, or related to women and men living and working together in close quarters;
3. health promotion and disease prevention; and
4. access to and delivery of health care.

The following sections elaborate on areas in which there are substantial gaps in knowledge. These areas are not intended to be all-inclusive. Breast cancer was not considered because of the separate and extensive DoD Breast Cancer Research Program.

Major Factors Affecting the Health or Work Performance of Military Women

Gynecologic and Reproductive Health. Considerable research has been conducted at military hospitals on topics related to pregnancy. Very little is being done to study the everyday aspects of the gynecologic or reproductive health of military women, especially in field conditions. Among important topics for study are the following:

- management of common gynecologic problems such as vaginitis,
- safe and feasible birth control methods in the field,
CONCLUSIONS AND RECOMMENDATIONS

- strategies for coping with or suppressing menstruation while in a combat or field situation and their long- and short-term sequelae,
- early identification and effective treatment of sexually transmitted diseases,
- rapid and accurate pregnancy screening methods,
- the scientific basis for pregnancy and postpartum policies—e.g., policies concerning permissible occupations and activities, when to return to duty or begin special training, how long to allow for returning to weight and physical fitness that meet service standards, and lactation after return to duty. (See also the sections “Health Promotion and Disease Prevention” and “Access to and Delivery of Health Care.”)

Nutrition. Nutritional status can have significant effects on performance. Studies of female athletes show diminished capacity in women with low energy intakes and/or deficiencies of such nutrients as iron and calcium. Other studies have suggested that increased consumption of specific nutrients can improve performance. Several nutritional studies of military women are under way that focus on the identification and correction of nutritional problems adversely affecting performance and overall health. Examples of topics that need further study include:

- the nutritional status of military women, accounting for life-cycle stage, military status (i.e., basic training, active duty, reserve), and job category;
- the acceptability and actual consumption of field rations and fluids by women and factors that influence food intake in the field, such as extreme environmental conditions, menstrual status, and extreme physical activity; and
- nutrient and fluid requirements for optimal performance of specific categories of jobs, tasks, and military status, under both normal and extreme environmental conditions.

Physical Fitness. Considerable research has been completed or is in progress that investigates strategies to increase strength, fitness, and endurance as they are uniquely relevant to women’s military performance. Gaps were identified in the following areas:

- optimal physical fitness for military women, methods to achieve it efficiently, and methods to maintain physical fitness throughout military service;
- scientific basis for methods to assess fitness—to use as a basis for standards, including those for postpartum physical fitness;
- interaction of the menstrual cycle with physical training and fitness assessment;
• prevention of musculoskeletal injuries (e.g., stress fractures) related to military training and job specialties;
  • safely maintaining physical fitness during pregnancy; and
  • relationship of menopausal status to military physical fitness and performance.

Adaptation to Environmental and Occupational Stressors. The degree of adaptation to occupational and environmental extremes can have profound effects on performance. Some research has identified gender-specific differences in response to stressors, but continued research is required to develop methods to promote optimal performance by women exposed to occupational and environmental extremes. Because physical exertion and environmental stress interact under complex conditions in the military, both laboratory and field studies of women under meaningful military circumstances are needed in areas such as the following:

• women’s physiological, psychological, and behavioral responses when exposed to operational stressors such as intense physical activity, extreme ambient environments (e.g., heat, cold, pollutants), fatigue, food restrictions, restrictive clothing, bulky or heavy equipment, or disturbances of biological rhythms;
• effects of various aspects of military life (e.g., intense, exhaustive exercise; psychological stress) on women’s immune function, health-related factors that impair immune function, and external factors (e.g., nutrients, hydration, performance aids) that may afford protection from such impairment—for example, does the use of various types of contraceptive agents affect the response to stress?
• short- and long-term safety and efficacy of specific strategies for enhancing performance under stress;
• potential gender-specific effects of infectious diseases encountered primarily outside the United States (such as visceral leishmaniasis); and
• methodologies for rapid diagnosis and safe and effective treatment of unusual diseases with special emphasis on gender, pregnancy, and ethnic background.

Protective Clothing and Equipment. Few of the many studies of the development and performance of protective clothing include women at all, and almost none explore any aspect of protective clothing and equipment for women in combat. Among the critical gaps that were identified are:
CONCLUSIONS AND RECOMMENDATIONS

- the application of anthropometric data to new approaches to sizing and to the design of end products that fit a variety of body segment combinations and body contours;
- gender and racial or ethnic differences in thermal balance when wearing body cooling and heating systems employing different media and locations on the body;
- endurance in women of various body sizes and types when loads are mounted in different configurations on various body locations; and
- methods for dealing with urination, defecation, menstrual flow, and other sanitary needs in a variety of military environments.

Drug Metabolism and Effects in Military Women. Understanding the effects of gender, ethnic background, menstrual cycle, and the interaction of these on the absorption and metabolism of drugs and their pharmacologic and adverse effects is increasing but remains limited even in the civilian population. The further interactions of stress, physical activity, and dietary changes add additional uncertainties regarding the optimal dosage and use of drugs and precautions needed for prophylaxis or therapy in military women under field-like conditions. It would be especially valuable to address these uncertainties in studies of such drugs as oral contraceptives (alone and interacting with other drugs); drugs affecting immune function (e.g., oral and inhaled corticosteroids); drugs with central nervous system effects (e.g., anxiety, antidepressant, analgesic, and antihistamine agents); antibiotics, antimalarials, and antifungal agents; and drugs for protection against and treatment of the effects of chemical and biological weapons.

Psychological Stress. Many emotional disorders of special relevance to women (e.g., depression) are being studied extensively in the civilian sector, and these studies should aid military women as well. Other disorders, such as PTSD, have been studied primarily in military men. Several disorders and areas of psychological research are especially important to military women who are in training or deployed. These include but are not limited to the following:

- combat stress reactions or PTSD following near death, loss of friends and colleagues, or viewing and participating in violence to the enemy;
- psychological effects (e.g., phobias) related to the use of protective clothing and equipment, and ways to ameliorate them;
- impact of family issues (e.g., repeated or long periods of separation from children resulting from deployment; lack of adequate or affordable child care; concerns about family well-being; problems meeting family needs related to low income) on servicewomen under conditions such as mobilization, deployment, training, or traumatic incidents;
RESEARCH ON THE HEALTH OF MILITARY WOMEN

- identification of factors (e.g., prior history of abuse, period of association with friends lost in combat, family issues) influencing the likelihood that trauma will result in PTSD;
- methods of preparing women for gender-specific aspects of captivity; and
- factors associated with low suicide rates in the military and their possible relevance to reducing other problems

Psychological and Health Issues Resulting from Integration of Women into a Hierarchical Male Environment, or Related to Women and Men Living and Working Together in Close Quarters

The relatively recent integration of women in the military calls for study of a number of health issues related to the close living and working conditions of men and women in the military. These issues include but are not limited to sexual harassment, physical abuse, and maintaining privacy and self-respect in close quarters. Although sexual harassment is the subject of a number of studies, additional research is needed concerning methods to eliminate the problem.

Examples of specific research problems include:

- the extent and impact of sex-role stereotyping of military women by military officers, noncommissioned officers, and enlisted personnel;
- the prevalence, contributing factors, and effects of physical and sexual assaults and sexual harassment of women in the Armed Forces;
- effects of premilitary sexual abuse or violence history and military traumatic experiences on psychological health and job performance;
- outcomes of treatment for traumatized servicewomen; and
- strategies for handling sanitary needs.

Health Promotion and Disease Prevention

Despite the large amount of civilian research in health promotion and disease prevention, the military situation presents opportunities and challenges that require study. For example, the high prevalence of sexually transmitted diseases (STDs) among military women (see chapter 1) points up the urgent need to study methodologies for rapid and accurate diagnosis, single-dose treatment and preventive measures, and to study the short- and long-term impacts of STDs on military women. In the population of military women, HIV infection is primarily a sexually transmitted disease because intravenous drug abuse is uncommon, and research should focus on its prevention.
CONCLUSIONS AND RECOMMENDATIONS

Other examples of important health promotion or disease prevention research topics include the following:

- effectiveness of health education, fitness programs, weight control programs, smoking cessation programs, alcohol treatment programs, and other educational or social marketing strategies intended to promote the health of military women;
- outcomes of efforts to improve women's ability to make informed health care decisions and to use military health care services effectively;
- prevention of vaginitis, cystitis, urinary tract infections, sexually transmitted diseases, incontinence, bladder and pelvic prolapse, procidentia, cystocele, and rectocele;
- psychological, environmental, and geographical factors that contribute to job stress and job satisfaction, such as gender role or gender conflict in occupational settings, family and parenting responsibilities, lack of adequate and affordable child care, sexual discrimination or harassment, and shift work; and
- gender-specific aspects of injury avoidance.

Further analysis of data from annual Health Risk Appraisals and the Army-Wide HIV/AIDS Risk Survey, giving special attention to racial and ethnic background, would provide important guidance for interventions aimed at smoking, drinking, poor nutrition, and risky sexual behavior.

For the general population, substantial data exist regarding adverse health consequences of weight cycling and disordered eating. Given the requirement to meet prescribed weight standards, there is a need to examine such topics as:

- the prevalence of disordered eating and its relationship to the meeting of weight and fitness standards;
- the prevalence of weight cycling in military women and the health and performance consequences of this practice;
- the scientific basis for weight and body composition standards used for induction and continuation in service (e.g., postpartum body composition standards); and
- the prevalence of menstrual dysfunction and subsequent health concerns such as stress fractures and osteoporosis.

Considerable animal research has been conducted on hazards to which military personnel may be exposed, but there is continuing need for evaluation of the extent and possible impact on women of occupational exposure to potential toxins, carcinogens, teratogens, pesticides, blast, repetitive impact shock, and electromagnetic radiation over both the short and the long term. Examples of substances include munitions residues, radioactive aerosolized
depleted uranium, single materials and mixtures of air pollutants (petroleum vapors, diesel and gasoline mixtures) similar to Persian Gulf exposures, petroleum mixtures and diesel or leaded gasoline fuels (materials used by military personnel in the Persian Gulf for unvented heating and to suppress sand and dust), and smoke (both from fires and from smoke generators).

**Access to and Delivery of Health Care**

Perhaps one of the most important areas for research is access to and delivery of women's health care. The committee found minimal research in this area, apart from prenatal and perinatal care. Health services research should be conducted to study the accessibility and availability of women's health services in field operations and ways that these might be improved (e.g., special training in gynecologic and reproductive health services, as noted in more detail later in this section).

One key to setting priorities for such research is obtaining input from military women about a wide range of health topics such as gender-related health concerns; coping mechanisms; sites where services are felt to be inadequate; and suggestions for health care related to training, specific job specialties, deployment, and combat operations. Which needs do women feel are currently being met, and which are not? What are their current health practices? What do they consider to be acceptable practices and interventions? What cultural differences should be considered in establishing standards and policies? Effective mechanisms are needed to collect such data from previously deployed women who are in the reserves as well as from active duty servicewomen.

The committee was concerned about reports that members of the military may fail to seek care for mental health problems for fear of adverse career impact. Topics for investigation include the following:

- effects of barriers to mental health care on mission performance;
- methods for reducing barriers to mental health care and the results of reducing them; and
- outcomes from alternative approaches to mental health care.

Other promising areas of women's health services research include the use and training of different types of health care providers in garrison and field, the expanded use of technology (including telemedicine), and comparisons of the health status of active duty and reserve women. Some of the many possible examples of studies related to health care services are listed below:
CONCLUSIONS AND RECOMMENDATIONS

- Comparison of a self-care program with usual medical care of women under training or field conditions: What should gender-specific self-care packs contain (e.g., for prevention or treatment of dysmenorrhea, cystitis, vaginitis, skin irritation, heartburn, diarrhea, constipation, and respiratory infection)? How could maximum stability of those drug products be ensured in field conditions? How should self-care packs be packaged? What instructions would best promote safe and effective use of these packs?

- Prevalence of the prescription and use of antibiotics, antianxiety drugs, and antidepressants and side effects related to their use: How do these practices relate to work performance and the need for other health services?

- Outcomes, including cost-effectiveness of training of general medical officers and of enlisted medical personnel to provide excellent gynecologic and reproductive health care: How might short courses in breast examination, pelvic examination, colposcopy with appropriate biopsies, and the treatment of such conditions as cystitis, vaginitis, and dysmenorrhea increase the availability of appropriate gender-related care at remote sites? Would such courses increase the satisfaction of military women with their care? How would care provided by such specialty trained personnel compare with that provided by those with usual training? Are there other ways to improve women’s health care at remote sites?

- Lack of access to pregnancy termination services (prohibited by the FY 1979 Defense Appropriations Act): What effects does this have on women’s health and retention in the military?

- Potential effects of screening programs on women’s health, evacuation numbers, and costs in recent deployments: For example, would rapid, accurate premobilization and predeployment pregnancy testing of servicewomen have decreased problems?

CONCLUDING REMARKS

The committee commends DoD and DWHRP for the initial steps taken to develop a strong research program on the health of military women. The committee’s overarching recommendations provide guidance for setting priorities and developing a strong, well-targeted program. Recommendations for research areas relate to gaps found in the research base. For maximum return of investment, the committee recommends long-term commitment to women’s health research, including longitudinal studies of military women and the design, development, and maintenance of databases necessary to support this type of research. Military service records should provide an excellent basis for long-term studies of the effects of racial or ethnic background, education, economic status, weight, body mass index, fitness, job specialization, high-risk
behaviors, and other factors on the development of gynecologic problems, hypertension, diabetes, heart disease, osteoporosis and fractures, joint disease and arthritis, mental status and Alzheimer's disease, a number of cancers, and other diseases of special concern to women. Research findings could be of direct benefit not only to DoD but to the entire nation.

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Recommendations for Research on the Health of Military Women: Bibliographies
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Committee on Defense Women’s Health Research

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The report to which this volume is an addendum, *Recommendations for Research on the Health of Military Women*, has been reviewed by a group other than the authors according to procedures approved by a Report Review Committee consisting of members of the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine. The current volume of bibliographies was not subject to report review.

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The serpent has been a symbol of long life, healing, and knowledge among almost all cultures and religions since the beginning of recorded history. The image adopted as a logotype by the Institute of Medicine is based on a relief carving from ancient Greece, now held by the Staatliche Museum in Berlin.
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Mindy S. Kurzer, Associate Professor, Department of Food Science and Nutrition, University of Minnesota, St. Paul, Minnesota
Judith H. Larosa, Professor of Public Health, Tulane University School of Public Health and Tropical Medicine, New Orleans, Louisiana
Roseann M. Lyle, Associate Professor of Health Promotion, Department of Health, Kinesiology and Leisure Studies, Purdue University, West Lafayette, Indiana
Charlotte F. Sanborn, Director, Center for Research on Women’s Health, Texas Woman’s University, Denton, Texas
Susan M. Watkins, Professor, Department of Textiles and Apparel, Cornell University, Ithaca, New York

Study Staff

Allison A. Yates, Division Director
Carol W. Suitor, Study Director
Frederick J. Manning, Senior Program Officer
Paul R. Thomas, Senior Program Office
Cathy T. Liverman, Program Officer
Carolyn E. Peters, Research Assistant
Laura A. CoLosi, Research Assistant
Thomas J. Wetterhan, Project Assistant
Patricia A. Takach, Project Assistant
Gail E. Spears, Administrative Assistant
Jamaine L. Tinker, Financial Associate

*Member, Institute of Medicine
Preface

This set of bibliographies was prepared to accompany the report Recommendations for Research on the Health of Military Women (Institute of Medicine, 1995). That report is based on a study conducted by the Committee on Defense Women’s Health Research of the Institute of Medicine on behalf of the U.S. Army Medical Research and Materiel Command (the Command), which manages the Defense Women’s Health Research Program (DWHRP).

DWHRP was established in FY 1994 to support research aimed at addressing the health-related needs of military women. Congress provided $40 million to the Department of Defense (DoD) in both FY 1994 and FY 1995, with the promise of additional funding in subsequent years, for intramural and extramural research relevant to the goals of the DWHRP. Those goals relate to mission readiness, deployment, and training.

The Command asked the Institute of Medicine for guidance on the use of appropriations for DWHRP. Particular attention was to be directed toward such topics as psychological stressors, physiological stressors, nutritional status, occupational safety issues, design of equipment and clothing, and special health care needs—all as related to servicewomen in training or deployment situations.

The Institute of Medicine appointed a 19-member committee (1) to identify gaps and strengths in past and current research relating to the health and performance of military women, and (2) to provide guidance on establishing research funding priorities. With guidance from the committee, the study staff conducted an extensive search of relevant studies from the published literature and from government reports of currently funded research. The committee reviewed the extensive bibliographies with available abstracts and used a deliberative process and collective expert opinion to develop its recommendations.

The broad scope of the searching resulted in retrieval of more than 5,700 citations of published works and 2,600 citations for current research. Citations that were obviously not relevant to the study were deleted by project staff. At the conclusion of the study, the database covering published works contained more than 2,100 references to relevant research on women’s health, and the database covering current research contained more than 1,100 references. This volume lists those references.

Chapter 1 outlines the search terms and online databases used to locate relevant articles and studies. Chapter 2 is divided into two parts. Part A includes references to published literature from the civilian databases, and Part B includes references obtained through the Defense Technical Information Center’s Defense Research, Development, Testing, and Evaluation Online System (DROLS). Chapter 3 is also divided into two parts. Part A provides a listing of relevant research in progress, excluding that funded by the Defense Women’s Health

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1 For ordering information about the report itself and about the published and electronic versions of this book of bibliographies, see the verso title page of this book.
Research Program. Part B covers the intramural research funded with FY 1994 appropriations by the Defense Women's Health Research Program.²

For both published and current research, citations were generally omitted if they covered health care problems that make servicewomen ineligible for deployment. Examples include chronic obstructive pulmonary disease, myocardial infarction, human immunodeficiency virus (HIV) infection, and diabetes mellitus. Many studies that dealt with the prevention of chronic diseases were included because of their relevance to the long-term health of military women.

It is hoped that potential investigators, current investigators, and Armed Forces practitioners will benefit from these bibliographies. Because of the large number of databases searched, these listings include studies that might be missed by routine searching and that might provide leads for other searches. The topical bibliographic listings provide a convenient starting point for a targeted, critical review of the literature. The topical listings of current research can stimulate communication among investigators with related interests. Review of the combination of published works and work in progress can suggest further aspects of research that have been ignored or require more attention. The electronic version of Recommendations for Research on the Health of Military Women: Bibliographies provides great flexibility in use of the references.

Reference


²Information about extramural research awards was not public when Recommendations for Research on the Health of Military Women: Bibliographies went to press.
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1 SEARCH STRATEGIES ........................................ 1

2 PUBLICATIONS .................................................. 19
   A Citations from Civilian Databases, 21
   B Reports from the Technical Reports Database—Defense Technical Information Center, 88

3 RESEARCH IN PROGRESS ....................................... 107
   A Current Research, 109
   B FY 1994 Defense Women's Health Research Program Intramural Projects, 152
The following pages contain the search strategies used to retrieve citations related to the health of military women. Searches were conducted from March through May 1995. Search terms were truncated or proximity searched to maximize retrieval. When available, database hierarchical structures were utilized (e.g., MeSH tree structures) to retrieve subordinate terms. Databases were searched for publication years 1985–1995 unless otherwise noted.

The searches are organized by general subject area and bibliographic database. These pages also contain the numbers of citations retrieved (for most of the searches) using the specified search terms or combination of terms. Where the number of citations is missing, the search was so broad that the numbers would not be meaningful.

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**ERIC—Psychosocial Issues**

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**PsychInfo—Psychologic and Physiologic Stress**

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### RESEARCH ON THE HEALTH OF MILITARY WOMEN: BIBLIOGRAPHIES

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RESEARCH ON THE HEALTH OF MILITARY WOMEN: BIBLIOGRAPHIES

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### NTIS—Strength

| s1            | performance, human or muscle contraction                             | 11,354              |
| s2            | s1 or muscle or physiology                                           | 12,198              |
| s3            | s2 or exercise or physiology                                         | 13,472              |
| s4            | s3 or psychomotor or bone density                                    | 13,918              |
| s5            | s4 or physical fitness                                               | 14,567              |
| s6            | s5 and sex                                                           | 16                  |

### Sport Database—Stressors or Physical Fitness or Health

| s1            | stress fractures                                                     | 416                 |
| s2            | upper body strength or muscle strength                                | 60                  |
| s3            | cold or body temperature regulation or aerobic capacity or fatigue or exertion or hunger or thirst or sleep deprivation or stressors | 8,747               |
| s4            | s3 and sex factor and comparative study                               | 72                  |
| s5            | nutrition assessment or nutrition status or eating disorders or caloric intake | 499                 |
| s6            | clothing and (sex factor or gender)                                  | 13                  |
| s7            | body fat and (performance or risk factors)                           | 165                 |
| s8            | (s1 or s2 or s5 or s6 or s7) and (military personnel or sex factor)   | 177                 |
| s9            | s8 or s3 not (elderly or child or adolescence) and language=English   | 106                 |
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| **NTIS—Physiological Stress** |                                                                      |                     |
| s1            | heat or heat exhaustion or cold or hypothermia or exertion            | 96,297              |
| s2            | s1 or humidity or food deprivation or hunger or water deprivation     | 102,756             |
| s3            | s2 or noise or hearing loss or acceleration or threshold              | 153,133             |
| s4            | s3 or vasoconstriction or stress or radiation or altitude            | 290,401             |
| s5            | s4 or thirst or fatigue or sleep deprivation or body temperature     | 115,722             |
| s6            | s5 and women or females and sex                                      | 42                  |

<p>| <strong>Medline, Embase, NTIS—Circadian Rhythm and Jet Lag</strong> |                                                                      |                     |
| s1            | circadian rhythm or jet lag                                          | 24,730              |
| s2            | s1 not animal not sleep deprivation                                   | 14,550              |
| s3            | s2 and female                                                        | 6,664               |
| s4            | s3 and (military personnel or athlete) not (elderly or child or adolescent or fetal) not (letter or case report or editorial or news) | 110                 |</p>
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<td>contraceptive agents, female or contraceptive devices, female or birth control</td>
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<td>s4</td>
<td>fetus or fetal</td>
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<td>s5</td>
<td>postpartum or puerperium</td>
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<td>s6</td>
<td>lactation or breast feeding</td>
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<td>infertility, female</td>
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<td>s1 through s8 combined</td>
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<td>s9 and female athletes (not news or letters or editorials)</td>
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### Medline, Embase, NTIS—Military Women and Other Body Systems

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### Medline, Embase, NTIS—Military Women and Other Body Systems

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<td>otorhinolaryngologic diseases</td>
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### Medline, Embase, NTIS—Other Health Conditions

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<td>s3</td>
<td>personal hygiene</td>
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<td>s4</td>
<td>s1 or s2 or s3 or s4 and (female and human)</td>
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<td>s5</td>
<td>s4 and military personnel</td>
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### Medline, Embase, NTIS—Rheumatology and Arthritis

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<td>s3</td>
<td>s1 and female athletes</td>
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</tr>
<tr>
<td>s4</td>
<td>s1 and gender differences or sex characteristics or sex factors</td>
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<tr>
<td>s5</td>
<td>s2 or s3 not (animal or elderly or adolescent or child or children or infant or news or letter or case report or editorial)</td>
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**ERIC—Military Personnel and Health or Health Care Services**

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<td>health needs or pregnancy or health services</td>
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<td>gynecology or medical services or health conditions</td>
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<td>s2 or s3</td>
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**Health Services/Technology Assessment Research (HStar)**

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**Dissertation Abstracts—Military Women**

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**NTIS—Women and Military**

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**Defense Technical Information Center Databases—Work Unit and Technical Report**

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<td>(stress fractures or bone fractures or protective clothing or protective equipment or anthropometry or ionizing radiation or electromagnetic radiation or altitude or hypoxia or hyperbaric conditions or low pressure or altitude sickness or noise or deafness or infectious diseases or biomechanics or clothing or bearing capacity) and women</td>
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### Defense Technical Information Center Databases—Work Unit and Technical Report

<table>
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<td>(estrous cycle or birth control or contraception or vaginitis or cystitis or urinary tract infection or incontinence or venereal diseases or gonorrhea or chlamydia or pregnancy or lactation or breast feeding or postpartum or immune disorders or cardiovascular diseases or respiratory diseases or skin diseases or gastrointestinal diseases or otorhinolaryngology or eating disorder or bulimia or anorexia or health care or health problem or health status or infectious disease or communicable diseases or mammary glands or orthopedic condition or injury or infertility or fertility or health service) and women</td>
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<tr>
<td>s4</td>
<td>(physiology or nutrients or nutrient requirements or nutrition status or nutritional status or athlete or operational stressors or tolerance or aerobic fitness or anaerobic fitness or pharmaceutical or biologicals or pollutants or toxicant or prescription drug or amenorrhea or stress fracture or diet or vitamins or antioxidants or calcium or iron or substrate utilization resistance training or physical fitness or strength or body weight or lipids or adipose tissue or endurance or reproduction or strength weight ratio or circadian rhythms or sleep deprivation or food deprivation or jet lag or exertion or hunger or thirst or water deprivation or thresholds or hormone replacement or analgesics or pharmacokinetics or pharmacodynamics or contraception or antiinflammatories or antiinflammatory agents or antidotes or stress or female athletic triad or reaction time) and women</td>
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<tr>
<td>s5</td>
<td>(depression or suicide or substance abuse or drug abuse or phobia or chemical warfare or biological warfare or protective clothing or posttraumatic stress disorder or PTSD or traumatic shock or stress or family or parent or isolation or rape or sexual assault or domestic violence or sexual harassment or child abuse or job stress or occupational readiness or personnel retention or training stress or job satisfaction or unit cohesion or sexual behavior) and women</td>
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### Federal Research in Progress

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<td>s58 and s3</td>
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<td>s64</td>
<td>hearing impairment or noise and health</td>
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<td>s60 and s3</td>
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<td>s67</td>
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<td>biomechanics and s3</td>
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<tr>
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<td>fatigue and (sleep or muscle)</td>
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<td>s71</td>
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<td>s72</td>
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<td>s69 and (performance or activity or stress or exercise)</td>
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<td>s75</td>
<td>s70 and s3</td>
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<td>s76</td>
<td>(calcium or iron) and (nutrient or nutrition)</td>
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<td>s77</td>
<td>substrate utilization</td>
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<td>s78</td>
<td>(s72 or s73) and s3</td>
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<td>s79</td>
<td>resistance training or weight training or postpartum fitness or muscle strength or physical strength</td>
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<td>s75 and s3</td>
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<td>body composition or body fat or densitometry or weight standards or adipose</td>
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<td>s84</td>
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<td>s85</td>
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### SEARCH STRATEGIES

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### CRIS/USDA—Nutrition Research in Progress

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<td>s2</td>
<td>s1 limited to the human nutrition subfile</td>
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<tr>
<td>s3</td>
<td>s1 not (elderly or aged or adolescent or child or children or infant)</td>
<td>244</td>
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Publications

This chapter lists the published scientific literature located through the online database searching described in Chapter 1 of this book and in Recommendations for Research on the Health of Military Women. This chapter is divided into two parts. Part A lists the citations retrieved in searches of Medline, EMBASE, PsycInfo, Agricola, NTIS, ERIC, Dissertation Abstracts, Occupational Safety and Health, Sociological Abstracts, SpaceLine, HStar, Social SciSearch, Sport, Textile Technology Digest, and Toxline. Part B lists the citations retrieved in searches of the Technical Reports database of the Defense Technical Information Center (DTIC). Since many of the Technical Reports citations are also found in the NTIS database, duplicates are listed only once, in Part B. Animal studies were retrieved only for studies in the Technical Reports database on military-related toxins. For foreign language articles, the language is given in brackets at the end of the citation.

The indexing terms listed below were used to assist the committee and the reader in organizing the large volume of literature. Some citations have been placed in more than one category.
Index Terms

anthropometry
body composition
body composition, obesity
bone
cardiovascular health
chemical defense
communicable diseases
cutaneous/dermal conditions
database
eating disorders
endocrine
family issues
gastrointestinal conditions
gynecologic/genito-urinary
gynecologic/reproductive health,
birth control
gynecologic/reproductive health,
lactation
gynecologic/reproductive health,
long-range implications
gynecologic/reproductive health,
postpartum
gynecologic/reproductive health,
pregnancy
health, general
health services
HIV/AIDS
job satisfaction
job stress
load-bearing
medical technology
menstrual cycle
military women, general
musculoskeletal, biomechanics
musculoskeletal, injuries
musculoskeletal, treatment
neurosensorv conditions
noise, hearing loss
nutrition
nutrition and exercise
otolaryngological conditions
performance
pharmaceutical
physical fitness, general
physical fitness, strength/endurance
protective clothing and equipment
psychological conditions
radiation
respiratory conditions
responses to stressors, physical activity
responses to stressors, pressure
responses to stressors, temperature
sexual assault/harassment
social support
STDs
substance abuse
toxins
traumatic stress, combat
traumatic stress, other
Part A

Citations from Civilian Databases

ANTHROPOMETRY


Coblentz A. Anthropometry and Dynamic Biomechanics. Paris, France: Anthropologie Appliquée; 1985. AA-181/85. [In French]


BIBLIOGRAPHY


BODY COMPOSITION


BODY COMPOSITION, OBESITY


BONE


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CARDIOVASCULAR HEALTH


CHEMICAL DEFENSE

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COMMUNICABLE DISEASES


**CUTANEOUS/DERMAL CONDITIONS**


**EATING DISORDERS**


de la Serna de Pedro J, Moreno Ol, Vinas PR. Comparative study of anorexia nervosa in a group of males and females. *Actas d Luq Esp Neurol Psiquiatr Cienc Afines* 1990;18(5):332-8. [In Spanish]


ENDOCRINE


FAMILY ISSUES


Segal MW. The military and the family as greedy institutions. *Armed Forces & Society* 1986;1(Fall):9-38.

**GASTROINTESTINAL CONDITIONS**


**GYNECOLOGIC/GENITO-URINARY**


**GYECOLOGIC/REPRODUCTIVE HEALTH, BIRTH CONTROL**

RESEARCH ON THE HEALTH OF MILITARY WOMEN: BIBLIOGRAPHY


GYNECOLOGIC/REPRODUCTIVE HEALTH, LACTATION


GYNECOLOGIC/REPRODUCTIVE HEALTH, LONG-RANGE IMPLICATIONS


GYNECOLOGIC/REPRODUCTIVE HEALTH, POSTPARTUM


GYNECOLOGIC/REPRODUCTIVE HEALTH, PREGNANCY


Lemarie PH, Lemarie-Dechriste D. Clinical aspects of pregnancy in the sportswoman. *Rev Fr Gynecol Obstet* 1986;81(9):469-72. [In French]


**HEALTH, GENERAL**


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Muller D, Hartmann B, Klingbeil M. Possibilities for cooperation between child and adolescent health protection, occupational health services and medical and military service. Z Gesamte Hyg 1987;33(8):388-9. [In German]


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HIV/AIDS


JOB SATISFACTION


Martin HP. The Integration of Women into the Military: A Preliminary Investigation of Relevant Factors. Austin, TX: University of Texas; 1987. Dissertation.


**JOB STRESS**


Bishop GD. Gender, role, and illness behavior in a military population. *Health Psychol* 1984;3(6):519-34.

Blower DJ, Dolgin DL, Shull RN. *Naval Aviation Selection Test Scores and Female Aviator Performance*. Pensacola, FL: Naval Aerospace Medical Research Lab; 1990.


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**MENSTRUAL CYCLE**


**MILITARY WOMEN, GENERAL**


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NWC-W84-82.


AU-AWC-88-188.

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**MUSCULOSKELETAL, INJURIES**


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Langstaff R, Handle C. Functional ankle instability in members of the armed forces, the results of the extensor digitorum brevis transfer operation. Injury 1991;22(2):105-7.

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NOISE, HEARING LOSS


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Matschke R. Communication and noise. Speech intelligibility of airplane pilots with and without active noise compensation. HNO 1994;42(8):499-504. [In German]

NUTRITION


Myhre K, Borch-Johnsen B. Iron and sports. Tidskr Nor Laegeforen 1990;110(2):192-5. [In Norwegian]


NUTRITION AND EXERCISE


Pavlica M, Obadacic B, Bevc Z, Milivojevic M, Sovtic P. The effect of nutrition and planned physical activity on the nutritional status, development and physical fitness in soldiers. Vojnosanit Pregl 1988;45(4):254-8. [In Serbo-Croatian (Roman)]
Sovtic P, Pavlica M, Milivojevic M, Obadacic B. Nutritional status, physical development and physical fitness of soldiers before and after training. Vojnosanit Pregl 1989;46(1):7-10. [In Serbo-Croatian (Roman)]
OTOLARYNGOLOGICAL CONDITIONS


PERFORMANCE


Dissertation.


PHARMACEUTICAL


PHYSICAL FITNESS, GENERAL


**PHYSICAL FITNESS, STRENGTH/ENDURANCE**


**PROTECTIVE CLOTHING AND EQUIPMENT**


RESEARCH ON THE HEALTH OF MILITARY WOMEN: BIBLIOGRAPHY


Guill F. What the aircrew automated escape system and aircrew life support system equipment designers need from the investigating medical officer and pathologist. Aviat Space Environ Med 1989;60(10 Pt 2):B1-10.


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**RESPONSES TO STRESSORS, PHYSICAL ACTIVITY**


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SEXUAL ASSAULT/HARASSMENT


SOCIAL SUPPORT


**STDs**


**SUBSTANCE ABUSE**


TOXINS


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**TRAUMATIC STRESS, COMBAT**


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**TRAUMATIC STRESS, OTHER**


RESEARCH ON THE HEALTH OF MILITARY WOMEN

Part B
Reports from the Technical Reports Database—Defense Technical Information Center

ANTHROPOMETRY


BODY COMPOSITION


88


CARDIOVASCULAR HEALTH


CHEMICAL DEFENSE


COMMUNICABLE DISEASES


EATING DISORDERS

FAMILY ISSUES


RESEARCH ON THE HEALTH OF MILITARY WOMEN


GASTROINTESTINAL CONDITIONS


GYNECOLOGIC, GENITO-URINARY


GYNECOLOGIC/REPRODUCTIVE HEALTH, BIRTH CONTROL


GYNECOLOGIC/REPRODUCTIVE HEALTH, LACTATION


GYNECOLOGIC/REPRODUCTIVE HEALTH, PREGNANCY


HEALTH, GENERAL


HEALTH SERVICES


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HIV/AIDS


JOB SATISFACTION


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**JOB STRESS**


**LOAD-BEARING**


**MILITARY WOMEN, GENERAL**


**MISCELLANEOUS**


**MUSCULOSKELETAL, INJURIES**


MUSCULOSKELETAL, TREATMENT


NOISE AND HEARING LOSS


NUTRITION


NUTRITION AND EXERCISE


PERFORMANCE


PHARMACEUTICAL


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Teague SM, Hordinsky JR. *Tolerance of beta blocked hypertensives during orthostatic and altitude stresses*. Cleveland, OH: Cleveland Metropolitan General Hospital, Division of Cardiology; 1992. A249904. 36p.

**PHYSICAL FITNESS, GENERAL**


PHYSICAL FITNESS, STRENGTH/ENDURANCE


PROTECTIVE CLOTHING AND EQUIPMENT


PSYCHOLOGICAL CONDITIONS


RADIATION


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RESPIRATORY CONDITIONS

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RESPONSES TO STRESSORS, OTHER


RESPONSES TO STRESSORS, PHYSICAL ACTIVITY


RESPONSES TO STRESSORS, PRESSURE


RESPONSES TO STRESSORS, TEMPERATURE


**SEXUAL ASSAULT/HARASSMENT**


**SOCIAL SUPPORT**


SUBSTANCE ABUSE


TOXINS


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TRAUMATIC STRESS, OTHER

Research in Progress

This chapter lists information on federally funded research currently in progress. It is divided into two parts. Part I lists the information retrieved by searching several online databases (Federal Research in Progress, CRIS/USDA, and the DTIC Work Unit) and through information received from federal agencies, including the Agency for Health Care Policy and Research, Centers for Disease Control and Prevention (CDC), Environmental Protection Agency, and the Maternal Child Health Bureau. The year of the award is included if it was available. Part B lists the intramural projects funded by the Defense Women's Health Research Program for FY 1994. Dollar amounts are reported for all studies for which they were available. These citations have been indexed as in chapter 2 with the terms on the following page. Some studies have been placed in more than one category.
Index Terms

body composition
body composition, obesity
bone
cardiovascular health
communicable diseases
cutaneous/dermal conditions
database
eating disorders
endocrine
family issues
gastrointestinal conditions
gynecologic/genito-urinary
gynecologic/reproductive health,
birth control
gynecologic/reproductive health,
lactation
gynecologic/reproductive health,
long-range implications
gynecologic/reproductive health,
postpartum
gynecologic/reproductive health,
pregnancy
health, general
health services
HIV/AIDS
hormone replacement therapy
job satisfaction
job stress
load-bearing
medical technology
menstrual cycle
miscellaneous
musculoskeletal, biomechanics
musculoskeletal, injuries
musculoskeletal, treatment
neurosensory conditions
noise, hearing loss
nutrition
nutrition and exercise
otolaryngological conditions
performance
pharmaceutical
physical fitness, general
physical fitness, strength/endurance
protective clothing and equipment
psychological conditions
radiation
respiratory conditions
responses to stressors, physical activity
responses to stressors, pressure
responses to stressors, temperature
sexual assault/harassment
social support
STDs
substance abuse
toxins
traumatic stress, combat
traumatic stress, other
Part A
Current Research

BODY COMPOSITION


BODY COMPOSITION, OBESITY


RESEARCH ON THE HEALTH OF MILITARY WOMEN: BIBLIOGRAPHIES


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BONE


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Burgess G (Department of Veterans Affairs, Medical Center, Palo Alto, CA). Effect of calcium-vitamin D supplementation with or without complete vitamin-mineral supplement on bone density in post-menopausal women. Department of Veterans Affairs, Research and Development.


Carver D (Department of Veterans Affairs, Medical Center, Palo Alto, CA). Long bone structural properties from bone densitometry. Department of Veterans Affairs, Research and Development.


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Bryg RJ (Department of Veterans Affairs, Medical Center, Reno, NV). Comparison of simastatin and fluvastatin in patients with primary hypercholesterolemia (type IIA and IIB). Department of Veterans Affairs, Research and Development.


Cohen JD (St. Louis University, St. Louis, MO). 1992. Trials of hypertension prevention—phase II. National Heart, Lung and Blood Institute.


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Eckberg DL (Department of Veterans Affairs, Medical Center, Richmond, VA). The hormonal role of circulating norepinephrine and its effects on arterial baroreflex sensitivity. Department of Veterans Affairs, Research and Development.


Goldberg AP (Department of Veterans Affairs, Medical Center, Baltimore, MD). Effects of strength training on risk factors for cardiovascular disease and self perceptions in post menopausal women. Department of Veterans Affairs, Research and Development.


Gupta SC (Department of Veterans Affairs, Medical Center, Dayton, OH). Efficacy and safety of pravastatin in patients with primary hypercholesterolemia compared with placebo. Department of Veterans Affairs, Research and Development.

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RESPONSES TO STRESSORS, OTHER

RESPONSES TO STRESSORS, PHYSICAL ACTIVITY


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RESPONSES TO STRESSORS, TEMPERATURE


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