UNDER SECRETARY OF DEFENSE
4000 DEFENSE PENTAGON
WASHINGTON, D.C. 20301-4000

PERSONNEL AND
READINESS

MAR - 7 2023

The Honorable Jack Reed
Chairman
Committee on Armed Services
United States Senate
Washington, DC 20510

Dear Mr. Chairman:

The Department's response to House Report 117–118, pages 174-175, accompanying H.R. 4350, the National Defense Authorization Act for Fiscal Year 2022, "Holistic Health and Fitness Programs," is enclosed. This report describes musculoskeletal injury prevention efforts focused on risk factors for musculoskeletal injuries, gaps in musculoskeletal injury prevention research, recommendations for a program office for the Army's performance health and fitness equipment, and the sustainment cycle for Soldier Performance Readiness Centers and gym equipment.

Thank you for your continued strong support for the health and well-being of our Service members. I am sending a similar letter to the Committee on Armed Services of the House of Representatives.

Sincerely,

Gilbert R. Cisneros, Jr.

Enclosure:
As stated

cc:
The Honorable Roger F. Wicker
Ranking Member

UNDER SECRETARY OF DEFENSE
4000 DEFENSE PENTAGON
WASHINGTON, D.C. 20301-4000

PERSONNEL AND READINESS

MAR - 7 2023

The Honorable Mike D. Rogers
Chairman
Committee on Armed Services
U.S. House of Representatives
Washington, DC 20515

Dear Mr. Chairman:

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Sincerely,

Gilbert R. Cisneros, Jr.

Enclosure:
As stated

cc:
The Honorable Adam Smith
Ranking Member

Report to the Congressional Armed Services Committees

Holistic Health and Fitness Programs

February 2023

The estimated cost of report or study for the Department of Defense (DoD) is approximately $21,000 for the 2022 Fiscal Year. This includes $0.00 in expenses and $21,000 DoD labor. Generated on October 31, 2022 Ref: 6-CA24BF7

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EXECUTIVE SUMMARY

This report is in response to House Report 117–118, pages 174-175, accompanying H.R. 4350, the National Defense Authorization Act for Fiscal Year (FY) 2022, which requests a report from the Secretary of Defense, in coordination with the Secretary of the Army and the Army Holistic Health and Fitness (H2F) System, on musculoskeletal (MSK) injury and prevention efforts. The report requests information on MSK injury prevention research efforts for all members of the Armed Forces as well any specific information on the Army H2F System. Specifically, the report requests information on MSK injury prevention research efforts for all members of the Armed Forces, gaps in MSK injury prevention research, an anticipated budget to address research gaps, recommendations for a program executive office to have oversight and management of the Army's performance health and fitness equipment, and recommendations for a sustainment cycle for performance centers and fitness equipment.

> *The committee recognizes that preventable musculoskeletal injuries negatively impact soldier health, Army readiness, and impose a significant healthcare cost burden. The committee also understands that the Army Holistic Health and Fitness (H2F) Program is designed to optimize individual performance and create stronger, fitter, and faster soldiers better prepared for the practical challenges they face both on and off the battlefield. Moreover, the committee recognizes that equipment and facilities are essential elements of the H2F system and that the Soldier Performance Readiness Center (SPRC) is an integral part of the H2F programming, as it provides a supportive individually focused fitness training environment where comprehensive, integrated, and immersive physical and nonphysical programming is delivered.*
>
> *Therefore, the committee directs the SecDef, in coordination with the Sec Army and the Army H2F Program, to submit a report to the HASC/SASC NLT April 1, 2022, that includes the following:*
>
> *(1) musculoskeletal injury prevention research efforts focused on identifying risk factors for musculoskeletal injuries among members of the Armed Forces and creating a better understanding for adaptive musculoskeletal and bone formation during initial entry military training.*
>
> *(2) gaps in musculoskeletal injury prevention research to include anticipated budget that would be suitable to fill these gaps.*
>
> *(3) recommendations on the designation of a program executive office that would have oversight and management of the Army's performance health and fitness equipment and facility acquisition, contracting, and sustainment processes.*
>
> *(4) recommendations to include a timeline on the establishment of a sustainment cycle for SPRCs, container gyms, Army Combat Fitness Test lane equipment, and used gyms-in-a-box.*

MSK injury and prevention research within the Department of Defense (DoD) aims to identify risk factors for MSK injuries among members of the Armed Forces and create a better understanding for adaptive MSK and bone formation during initial entry military training. The Military Operational Medical Research Program (MOMRP) is the leader in military medical

MSK research for the Defense Health Agency (DHA) and the Army, and utilizes an established research and product development process, enabling integrated research programs via a strategic research plan to address MSK injuries experienced by the Armed Forces. Current research aims to generate a better understanding of injury risk factors, develop recommendations to reduce injury, and improve screening processes.

Research gaps are typically identified through a feedback mechanism, which identifies current or potential capability gaps and operational and research needs and provides recommendations to address these gaps. MSK injury prevention objectives are to address identified gaps including, but not limited to, studying the causes of physical and physiological injuries, developing capabilities to mitigate injury risk for operationally relevant functional fitness tasks, understanding load-bearing injuries and strategies to enable sustained Service member effectiveness, and developing standards to measure the impact of injuries on readiness. MSK injury prevention research is typically funded through Research, Development, Test, and Evaluation (RDT&E), with the majority of activities funded through budget activities 6.1, 6.2, and 6.3. The annual Program Objective Memorandum (POM) funding for FY 2023 to address the MSK injury research gaps is approximately $2.5M, $9.4M, and $5.3M for RDT&E budget activities 6.1, 6.2, and 6.3, respectively as shown in Table 1.

The Army identified U.S. Army Training and Doctrine Command (TRADOC) Center for Initial Military Training (CIMT) as the supporting command for developing and establishing the H2F System. This system integrates related programs and establishes unity of effort. TRADOC/CIMT will have oversight and management of the Army's performance health, fitness equipment, facility acquisition, contracting, and sustainment processes.

Finally, sustainment cycles for Soldier Performance Readiness Centers (SPRCs) and gym equipment can vary depending on environmental factors. The Army's SPRC facilities generally have a 25-year sustainment cycle with shorter lifespans for certain systems such as heating, ventilation, and air conditioning (HVAC), transformers, and fans. Comparatively, container gyms, Army Combat Fitness Test (ACFT), and Gyms-in-a-Box (GIB) equipment replenishment requirements are dependent on location, frequency of use, and type of equipment. Container gyms and GIB are synonymous.

INTRODUCTION

Preventable MSK injuries negatively impact Service member health and military readiness and can impose a significant healthcare cost burden for the DoD. From the perspective of the Army, mitigating MSK injuries can improve overall Soldier health, reduce the impact to Army readiness, and decrease the overall cost burden of injuries. The H2F System focuses on readiness and lethality, optimal physical and non-physical performance, reduced injury rates, improved rehabilitation after injury, and increased overall effectiveness of the Total Army. The program empowers and equips Soldiers to take charge of their health, fitness, and well-being to optimize individual performance, while preventing injury and disease. Best practices, when applied to warfighter management and mission planning in tactical environments, bolster performance and enhance readiness.

MSK pain can be acute (sudden and severe) or chronic (long-lasting), resulting from traumatic or overuse injury. Traumatic MSK injuries are typically sustained from a sudden onset of high intensity forces at one point in time. Comparatively, overuse injuries are gradual onset, resulting from repetitive overload during recurrent physical activity. Training-related injuries can occur as either a traumatic or overuse injury of the back, pelvis, and extremities. The young healthy military population is susceptible to MSK conditions as a result of training-related traumatic or overuse injuries, potentially due to the volume of weight-bearing activity and insufficient time for adaptation or recovery. MSK injuries result in limited duty days and impact deployability rates and separation rates, affecting military readiness. MSK injury and prevention research can help mitigate both volume and impact of MSK-related injuries.

MSK INJURY AND PREVENTION RESEARCH EFFORTS TO IDENTIFY RISK FACTORS FOR MSK INJURY

MSK injury and prevention research within the DoD aims to identify risk factors for MSK injuries among members of the Armed Forces and create a better understanding for adaptive MSK and bone formation during initial entry military training. Injury prevention and reduction research develops models to predict the degree of injury from known threats, develops design guidelines and performance specifications for protective equipment, and identifies countermeasures to prevent or mitigate injury to the Service member. The MOMRP is the leader in military medical MSK research for DHA and the Army. The MOMRP and utilizes an established research and product development process, enabling integrated research programs via a strategic research plan to address MSK injuries experienced by the Armed Forces. The strategic research plan is generated from input from stakeholders including TRADOC and U.S. Army Forces Command, Marines School of Infantry East and West, U.S. Special Operations Command, and others.

The MOMRP drives cutting-edge scientific research and delivers Joint solutions to the battlefield and at home in a relevant, timely manner. Briefly, MOMRP programmatic goals include: 1) generating a better understanding and characterize injury risk factors for all the Services; 2) developing recommendations and guidelines to reduce injury risk; 3) conducting better screening; and 4) transitioning research findings and products to the respective operational commands and DoD leadership.

A recent accomplishment of MSK injury research and prevention efforts includes the development and delivery of a physical assessment criteria that provided the building blocks for the Occupational Physical Assessment Test (OPAT), which was implemented by TRADOC across the Army. The OPAT identifies individuals who have the capabilities to perform some of the Army's most physically demanding military occupational specialties (MOS), such as those in the Combat Arms, as well as individuals who are not yet physically prepared to start training. Active investments in the development of injury prediction models and equipment design specifications are working to refine the physical performance thresholds for Army recruitment that will support MOS assignment decision making and help to reduce the risk of MSK injury.

Additionally, U.S. Army Research Institute of Environmental Medicine (USARIEM) conducted the ARIEM Reduction in Musculoskeletal Injury (ARMI) prospective study, focusing on military population-level injury investigations, bone health analysis (e.g., high resolution non-invasive imaging, bone finite element analysis), anti-inflammatory strategies, injury mechanisms, and biomarker studies (USARIEM, 2022). In partnership with the U.S. Army Medical Research and Development Command, H2F, and TRADOC-CIMT leadership, this effort tracked up to 4,000 trainees during Basic Combat Training (BCT) to develop the Commander's Toolkit, which includes tools to aid in identifying those at greatest risk of MSK injury, identify risk factors and physiological mechanisms that contribute to MSK injury, and recommendations to reduce MSK injury risk (e.g., sleep, updated guidelines for non-steroidal anti-inflammatory drug use, nutritional optimization through whole food plant sources, and role of body composition).

The ARMI subject population data also support the delivery of strategies to identify early risk of stress fracture using emerging ultrasound technology and updated evidence-based guidance; and increasing the understanding of the roles/influence that contraceptives, oxidative stresses, and walking biomechanics have on MSK injury risks. The ARMI study highlighted above is tracking bone adaptation during Army BCT to identify whether bones become stronger with physical training. Anticipated outcomes of this research are recommendations of modifiable factors to reduce stress fracture risk and optimize bone adaptation.

The USARIEM also partnered with the University of Pittsburgh to identify and characterize proteomic biomarkers of MSK resilience/injury in Army trainees. MOMRP partnered with the University of Pittsburgh funding to quantify bone density, microarchitecture, and biomechanical property adaptations resulting from training, and to evaluate the physiological mechanisms underpinning exercise-induced adaptive bone formation. Results from this investigation will enhance/improve exercise training programs with the goal of optimizing bone health. Additionally, the outcomes related to physiological mechanisms influencing bone adaptation will inform future research investigations on the effects of military-relevant stressors, including, but not limited to, caloric restriction and impaired sleep, on bone adaptations to training.

Described above, the MOMRP processes promote integrated MSK injury research programs, in which researchers identify risks in Navy/Marines and Air Force initial military training populations. In collaboration with the Air Force 59th Medical Wing, researchers are investigating incidence and outcomes of bone stress injuries during Air Force Basic Military

Training. This research will help determine the correlation between modifiable risk factors (fitness level, past activity level, step count, run form, vitamin D status, sex, Depo Provera use, etc.) and the development of bone stress related injuries.

Another example is research occurring at the Naval Health Research Center (NHRC) in San Diego to reduce overuse injury risk during basic training at Marine Corps Recruit Depot (MCRD). Approximately 60 percent of all injuries documented at MCRD sports medicine clinic are due to overuse/overtraining. As a result, NHRC is conducting studies that examine the efficacy of functional movement screens as tools for assessing MSK injury susceptibility, identify overtraining pro- inflammation markers as predictors of MSK injury, and quantify total workload and caloric expenditure during physical loading to develop recommendations to reduce overuse injury risk during basic training MCRD. Further, NHRC researchers are collaborating with the Colorado School of Mines to develop a human MSK model that will incorporate realistic training loading to predict joint loading and injury risk during simulated training hikes.

Finally, the MOMRP funds research at the Uniformed Services University of the Health Sciences (USUHS), in partnership with NHRC, to identify barriers and drivers to prompt injury reporting by U.S. Marine Corps trainees, Drill Instructors (DIs) and Combat Instructors (CIs). The goal of this project is to inform/modify the education of MCRD and School of Infantry-West (SOI-W) DIs/CIs and recruits/students by promoting early treatment of injuries, addressing site-specific barriers at each, and assessing the impact of embedded athletic trainers at SOI-W on injury rates, healthcare utilization, and career progression. The Congressionally Directed Medical Research Program also awarded the USUHS funding to develop strategies to optimize return to duty outcomes in military training after shoulder and knee instability injuries.

GAPS IN MSK INJURY PREVENTION RESEARCH

Research gaps are typically identified through a feedback mechanism, which identifies current or potential capability gaps and operational and research needs, and provides recommendations to address these gaps (MHS, 2022). Briefly, the prospective mission and capabilities are defined, and gaps are identified with consideration from multiple sources (e.g., Centers of Excellence, military medical treatment facilities, clinical communities, and operational needs). Identified gaps are assessed for operational risk and feasibility and prioritized via coordination across different DoD Components and partners, which include, but are not limited to, the end-users and operational, science and technology, and medical communities. Recommendations for prospective research and material or non-material products and solutions are then identified to address operational needs and capability gaps.

Primary MSK injury prevention objectives to address gaps identified during the MOMRP capabilities-based assessment (2018) include, but were not limited to:

- Understanding the spectrum and causes of MSK injuries, the lifespan of physical/physiological injuries, and leveraging that understanding in developing knowledge and physical capabilities to prevent/reduce injury.

- Developing knowledge or physical capabilities that enhance performance and/or prevent or mitigate injury risk for operationally-relevant functional fitness tasks or programs.

- Identifying, characterizing, and understanding the spectrum and causes of MSK injuries to inform knowledge and physical capabilities to protect, sustain, and/or optimize Service member health, readiness, and performance.

- Identifying, characterizing, and understanding load-bearing injuries and strategies to enable continued and sustained Service member effectiveness (including the differentiation of the nature of load-bearing injuries on different sexes).

- Developing metrics and standards by which to measure fitness/conditioning and preexisting injuries/conditions to determine the likely impact on readiness.

Research continues to identify components of military training and operations contributing to increased risk for MSK injury. Research projects that can help address the gaps above include identifying the biochemical genetic, proteomic, psychosocial, and physiological mechanisms that contribute to MSK injury and recovery from injury, and subsequent return to duty. Additionally, evaluating screening, diagnostic, and prediction tools for use with Service members in physically demanding military occupations can help identify those at greatest risk for injury and develop mitigation strategies for recovery. Similarly, research to improve rehabilitation strategies can facilitate improve treatment and treatment outcomes, will help mitigate the impact of MSK injury on military readiness.

ANTICIPATED BUDGET TO FILL MSK INJURY PREVENTION RESEARCH GAPS

MSK injury prevention research is typically funded through RDT&E. RDT&E funding is divided into seven budget activities: 6.1 Basic Research; 6.2 Applied Research; 6.3 Advanced Technology Development; 6.4 Advance Concept Development and Prototypes; 6.5 Systems Development and Demonstration; 6.6 Management Support; and 6.7 Operational System Development (DAU, 2021; 59 MDW, 2021).

Over 54 percent of funds align to 6.2, Applied Research, supporting development and evaluation of initial concepts in the laboratory, in training, and in simulated exercises. This funding will help accelerate the development of projects and capabilities from Small Business Innovation Research, congressionally funded projects appropriated to the Military Departments, Special Operations, or to the Defense Health Program-funded Congressionally Directed Medical Research Program, and material and non-material products that are developed directly from industry and academia.

Approximately 15 percent of funds align to 6.1, Basic Research, focusing on epidemiology and basic research, enabling greater knowledge and understanding of fundamental principles of science and medicine. Briefly, these funds will help identify at risk populations and develop novel precision medicine approaches, including intervention, to prevent injury. The remaining 31 percent of funds align to 6.3, Advanced Technology Development. Research and

potential products funded via 6.3 budget activity will help develop solution and components of early protype systems for test and evaluation. These activities support capability maturation and establishment of transition agreements with DoD collaborators and/or partnerships with industry. The annual POM estimates to address the gaps described in the previous section are provided in Table 1 below.

Table 1. POM estimates for FY 2023 to fund MSK injury prevention research gaps (anticipated breakdown of activities include 60 percent direct scientific costs and 40 percent indirect costs (project management, laboratory overhead, travel).

Appropriation	**RDT&E Budget Activity**		
	6.1	**6.2**	**6.3**
Army	$1.1M	$3.6M	$1.3M
DHP	$1.4M	$5.8M	$4.0M

RECOMMENDATION OF A PROGRAM EXECUTIVE OFFICE

The Army identified TRADOC/CIMT as the supporting command for developing and establishing of the Army's performance health and fitness equipment and facility acquisition, contracting, and sustainment processes. This program integrates related programs and establishes unity of effort. TRADOC/CIMT will have oversight and management of the Army's performance health, fitness equipment, facility acquisition, contracting, and sustainment processes (TRADOC, 2018).

A Program Executive Office for oversight and management of the Army's performance health and fitness equipment and facility acquisition, contracting, and sustainment processes does not exist; however, executive agencies have been identified in a series of Army Execution Orders (EXORDs). Army health and fitness equipment, collectively called H2F equipment, is comprised of three different categories: ACFT equipment, deployable training equipment (e.g., GIB), and deployable medical equipment sets used by medical practitioners assigned to Brigade H2F Performance Teams. GIB, performance lockers, and container gyms are considered synonymous. The Army currently has two types of these containerized gyms; the older performance lockers and the newer versions, which are simply referred to as GIB. According to Army EXORD # 149-19 (Fragmentary Order 2), the Army Materiel Command is responsible for the sustainment and contracting of all H2F equipment. The Army Materiel Command is also responsible for the acquisition of ACFT equipment and container gyms. The Army Futures Command is responsible for the acquisition of medical equipment sets in accordance with Army EXORD # 149-19 (Fragmentary Order 1). Lastly, the only facility associated with H2F is the SPRC.

The Army uses a successful proponent framework laid out in Army Regulation 5-22, "The Army Force Modernization Proponent System," to assign roles and functions to achieve unity of effort and assign clear authorities and responsibilities for most of its non-operational missions. In general, the Headquarters, Department of the Army, staff are assigned as Staff Proponents to develop policies and execute programming. Commanders, in most cases TRADOC Center of Excellence commanders, are responsible for the doctrine, organization, training, materiel, leadership and education, personnel, and facilities policy integration across

mission areas, or are Functional Proponents when responsible for a subset of the doctrine, organization, training, materiel, leadership and education, personnel, and facilities policy.

Army EXORD 149-19, published in May 2019, identified TRADOC/CIMT as the supported command for developing and establishing the H2F System.

ESTABLISHMENT OF A SUSTAINMENT CYCLE FOR SPRCS AND GYM EQUIPMENT

The Army's SPRC facilities generally have a 25-year sustainment cycle with shorter lifespans for certain systems such as HVAC, transformers, and fans. For example, information technology equipment utilized in SPRC's typically has a 5-year sustainment cycle. Further, sustainment cycles can vary greatly depending on environmental factors and whether the facility is a converted building or newly constructed facility.

There are numerous variables that contribute to the sustainment cycle of container gyms, ACFT Lane equipment, and GIB equipment. The main factors that impact the sustainment cycle are location (outdoors vs. indoors), frequency of use, and type of equipment (durable, such as kettlebells, or non-durable, such as exercise bands), which have different replenishment cycles. For example, as indicated in Table 2, kettlebell equipment replenishment is extended by two years if used in an indoor facility.

Table 2. Examples of recommended equipment replenishment: outdoor vs. indoor.

Item Name	Recommended	
	Outdoor	Indoor
Hexagon Bar (60lb)	3 Years	5 Years
10lb Bumper Plate (single)	2 Years	3 Years
15lb Bumper Plate (single)	2 Years	3 Years
25lb Bumper Plate (single)	2 Years	3 Years
35lb Bumper Plate (single)	2 Years	3 Years
45lb Bumper Plate (single)	2 Years	3 Years
2.5lb Metal Change Plate (single)	2 Years	3 Years
Barbell Collars (set)	6 months	6 months
Nylon Drag Sled	1 year	1 Year
10lb Medicine Ball	2 Years	3 Years
40lb Kettlebell	3 Years	5 Years
Measuring Tape	1 Year	2 Years
Incline/Decline Bench	2 Years	5 Years
10lb Soft Medicine Ball	2 Years	3 Years
12lb Soft Medicine Ball	2 Years	3 Years
14lb Soft Medicine Ball	2 Years	3 Years
16lb Soft Medicine Ball	2 Years	3 Years
18lb Soft Medicine Ball	2 Years	3 Years
20lb Soft Medicine Ball	2 Years	3 Years
Mini Bands Light	6 months	1 Year
Mini Bands Medium	6 months	1 Year

Mini Bands Heavy	6 months	1 Year
Mini Bands Extra Heavy	6 months	1 Year
Mobility Band Extra Light	6 months	1 Year
Mobility Band Light	6 months	1 Year
Mobility Band Medium	6 months	1 Year
Mobility Band Heavy	6 months	1 Year
Mobility Band Extra Heavy	6 months	1 Year
Agility Ladder 15'	1 Year	1 Year
Jump Rope	1 Year	1 Year
Suspension Trainer	3 Years	3 Years
Balance Trainer	2 Years	2 years
Battle Rope	1 Year	2 years
Sandbag Trainer small (10-40lb)	1.5 Years	3 Years
Sandbag Trainer Large (20-80lb)	1.5 Years	3 Years

CONCLUSION

Preventable MSK injuries negatively impact Service member health and military readiness. MSK injury and prevention research within the DoD aims to identify risk factors for MSK injuries among members of the Armed Forces and create a better understanding for adaptive MSK and bone formation during initial entry military training. Current research aims to generate a better understanding of injury risk factors, develop recommendations to reduce injury, and improve screening processes; however, gaps in research and capabilities still exist.

Current objectives to close identified gaps in MSK injury prevention research include studying the causes of physical and physiological injuries, developing capabilities to mitigate injury risk for operationally-relevant functional fitness tasks, understanding load-bearing injuries and strategies to enable sustained Service member effectiveness, and developing standards to measure the impact of injuries on readiness. The annual POM estimates to address the MSK injury research gaps are approximately $2.5M, $9.4M, and $5.3M for RDT&E budget activities 6.1, 6.2, and 6.3, respectively.

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APPENDIX: LIST OF ACRONYMS

ACRONYM	DESCRIPTION
ACFT	Army Combat Fitness Test
ARMI	ARIEM Reduction in Musculoskeletal Injury
BCT	Basic Combat Training
CI	Combat Instructor
CIMT	Center for Initial Military Training
DHA	Defense Health Agency
DI	Drill Instructor
DoD	Department of Defense
EXORD	Execution Order
FY	Fiscal Year
GIB	Gyms-In-a-Box
H2F	Holistic Health and Fitness
HVAC	heating, ventilation, and air conditioning
MCRD	Marine Corps Recruitment Depot
MOMRP	Military Operational Medicine Research Program
MOS	military occupational specialty
MSK	musculoskeletal
NHRC	Naval Health Research Center
OPAT	Occupational Physical Assessment Test
POM	Program Objective Memorandum
RDT&E	Research Development Test and Evaluation
SOI-W	School of Infantry-West
SPRC	Soldier Performance Readiness Center
TRADOC	U.S. Army Training and Doctrine Command
USARIEM	U.S. Army Research Institute of Environment Medicine
USUHS	Uniformed Services University of the Health Sciences