Cambridge Quarterly of Healthcare Ethics (2022), 31: 4, 557–569
doi:10.1017/S0963180122000421

CAMBRIDGE UNIVERSITY PRESS

ARTICLE

Can We Justify Military Enhancements? Some Yes, Most No

Blake Hereth* and Nicholas Evans

University of Massachusetts, Lowell, Massachusetts 01854, USA
*Corresponding author. Email: Blake_Hereth@uml.edu

Abstract

The United States Department of Defense has, for at least 20 years, held the stated intention to enhance active military personnel ("warfighters"). This intention has become more acute in the face of dropping recruitment, an aging fighting force, and emerging strategic challenges. However, developing and testing enhancements is clouded by the ethically contested status of enhancements, the long history of abuse by military medical researchers, and new legislation in the guise of "health security" that has enabled the Department of Defense to apply medical interventions without appropriate oversight. This paper aims to reconcile existing legal and regulatory frameworks on military biomedical research with ethical concerns about military enhancements. In what follows, we first outline one justification for military enhancements. The authors then briefly address existing definitional issues over what constitutes enhancement before addressing existing research ethics regulations governing military biomedical research. Next, they argue that two common justifications for rapid military innovation in science and technology, including enhancement, fail. These justifications are (a) to satisfy a compelling military need and (b) strategic dominance. The authors then turn to an objection that turns on the idea that we need not have these justifications if warfighters are willing to adopt enhancement, and argue that laissez-faire approaches to enhancement fail in the context of the military due to pressing and historically significant concerns about coercion and exploitation. The paper concludes with what is referred to as the "least-worst" justification: Given the rise of untested enhancements in civilian and military life, we have good reason to validate potential enhancements even if they do not satisfy reasons (a) or (b) above.

Keywords: enhancement; military enhancements; military biomedical research

Introduction

There is a long history of technology being leveraged for military applications. Within this, the quest to enhance military performance extends back to antiquity.[1] Warriors in sixth century CE Ethiopia are recorded mixing coffee berries with fat to enhance alertness and aid in long marches, though plants containing caffeine have been consumed as far back as the Paleolithic.[2] In the Second World War, Allied and Axis forces consumed large quantities of stimulants, including methamphetamine, during battles. Methamphetamine was a staple of fighter pilots well into the 21st century.[3] Wars are won by soldiers, and those soldiers are almost always on something.

Arguably the most famous military performance enhancement today is modafinil, which allows users to operate for up to 30 consecutive waking hours without the loss of function associated with sleep deprivation. Modafinil, discovered by Israeli scientists and ultimately approved as a treatment for narcolepsy, finds use in combat operations as a replacement for and, ultimately, a better alternative for the amphetamines traditionally used by fighter pilots.[4] In civilian life, this enhancement effect is partially reclassified as a treatment for "shift work disorder," allowing individuals whose lives and work do not allow them to get a good night's sleep at the appropriate time. It is also prescribed, under similar auspices, to students looking to spend longer hours studying.

This "dual-use" in which an enhancement is used in both civilian and military contexts is reflected in the ostensibly civilian, broader scientific effort in which enhancement (and cognitive enhancement, in particular) is pursued. The United States Brain Research through Advancing Innovative Neurotechnologies (BRAIN) Initiative[5] is an unclassified, civilian-led project to develop novel science and technology development in neuroscience, but partners heavily with both the Defense Advanced Research Project Agency (DARPA), which has funded cognitive enhancement research for decades, and received almost a third of the 2016 BRAIN initiative funding, and continues to operate as a major partner in the initiative along with the Intelligence Advanced Research Projects Activity (IARPA) the intelligence community's version of DARPA. Through this funding, DARPA has developed enhancement technologies as benign as advanced training regimens using neuroplasticity, through brain-computer interfaces that connect individuals' brains to machines, or even to other minds.

The transition from basic science to the application of these enhancements in humans is ethically fraught, however, in two important ways. First, contemporary research ethics traditionally emphasize justifying the role of human subjects in research on the basis of a clinical illness or pathology for which an intervention is potentially suited to resolving. In no case is this therapeutic necessity present in enhancements; individuals typically do not receive these enhancements to cure what makes them sick. This presents a quandary for research ethics. Rather than saying contemporary research ethics forbid enhancement research, it might be better to say that contemporary research ethics provide little to no guidance on the ethics of enhancement research.

Framing the problem as one of a lack of guidance is important, because the presence of an illness for which an intervention is potentially effective is neither the only nor always the most important principle in justifying human experimentation. Enhancements pose potentially serious risks, as biomedical interventions can be expected to have side effects even on the healthy. In the case of treating clinical illness, the expected side effects of an intervention are justified just in case the patient gives informed consent and the side effects are outweighed by the expected benefits of an intervention. Yet, while drugs like modafinil are already being prescribed off-label to enterprising students who wish to study longer and harder than their peers,[6] we have almost no clinical information on the risk–benefit ratio of modafinil as an enhancement, much less its interaction with other drugs (e.g., antidepressants). What data we possess indicate that the benefits of modafinil to a person who is not clinically sleep-deprived are quite modest, with a moderate effect on attention, a negative effect on wakefulness, and no effect on mood or executive function. It does, however, come with potential side effects, including insomnia in non-sleep-deprived individuals, gastrointestinal complaints, nervousness, and tachycardia.[7] Although well-tolerated relative to its benefits, these may change the risk–benefit calculation for patients and providers alike, especially for enhancement purposes, and highlight the importance of collecting safety and efficacy data for enhancements.

The second major ethical concern with enhancements is that warfighters are a vulnerable population prone to coercion and exploitation by virtue of their role. Warfighters are expected to accept medical interventions that render them fit for duty, and in the past, this has been understood to include interventions that enhance or sustain their performance.[8] The Department of Defense (DOD) subscribes to the Common Rule, the federal rule that governs research with human subjects, and in addition, the military human research protection plan (HRPP) forbids the presence of superior officers during the solicitation of research subjects and demands informed consent, medical supervision, the right to end an experiment, and an independent ombudsman or research monitor to oversee recruitment and experimentation.[9] Additional safeguards include approaching potential subjects privately rather than in groups and requiring participants to explain the information in consent documents in their own words to ensure comprehension.[10] This concern thus spans the life cycle of enhancement, from basic research to ultimate use.

Concerns persist, however, that human subjects research and the use of experimental interventions in the military, particularly in the realm of enhancement, will coerce, exploit, or unduly influence warfighters.[11] There are strong incentives to produce newer, better soldiers.[12] The U.S. armed forces are suffering from a dearth of suitable applicants. In elite Special Operations Forces (SOF), the shortfall is approximately 400 per year. As of 2018, the average age of an SOF operator is now 38 and rising.[13]

Without either a strong institutional change or a way to keep warfighters stronger for longer, the U.S. Armed Forces' weakest link is its personnel.[14]

Further complicating matters is the fact that the United States has a long, abusive history in the name of medical innovation. The now-infamous Human Radiation Experiments were on warfighters (in addition to pregnant women, people with disabilities, and others) without the consent or understanding of the subjects. This occurred despite the DOD being the first and only U.S. agency to explicitly endorse and use the Nuremberg Code,[15] and despite the creation of informed consent guidance for those experiments—guidance which, due to the "born classified" rules surrounding fissile materials, was classified and thus inaccessible.[16] In 2003, service members sued the DOD for requiring all active personnel to submit to the Anthrax Vaccine Immunization Program (AVIP) without securing informed consent or—in violation of its own guidelines—securing a waiver of informed consent based on military necessity.[17] That program ultimately went ahead with the assistance of the new federal Project Bioshield Act, but the DOD would later be charged with failing to appropriately monitor warfighters post-vaccinations and misreporting adverse event rates.[18]

A central problem is that the incentive to innovate in the name of national security can be a perverse one when it is taken to trump all other moral concerns. The need to innovate for reasons of strategic dominance has been claimed to be a moral imperative.[19] Yet the moral value of strategic dominance, and how it ought to mediate existing research ethics concerns, is not clear. Although there is considerable work on the ethics of research conducted within a crisis such as a large infectious disease outbreak,[20] there is no direct analogy between a crisis and the kind of research enhancement constitutes. Enhancement is in preparation for a potential crisis—war—but is not itself conducted in the context of a crisis.

Moreover, although there has been work conducted on the ethics of enhancement research,[21] little of this addresses the military ethical issues that intersect with the biomedical ethical issues in human subjects research.[22] This is a severe problem for assessing the ethics of military enhancement research. Even if enhancements simpliciter might be justified under some idea of necessity, for example, what counts as "necessary" in the domain of armed conflict is a much higher bar because it involves the use of lethal force on others.[23] And here, it may not be clear how, or in which direction a drug that increases wakefulness, or changes metabolism, or some other effect changes the responses of soldiers in practice to the lethal contexts in which they find themselves. Military ethics, and the use of technology in aid of military objectives, thus face a different set of ethical hurdles because the result of these enhancements is making an individual or group of warfighters better at their job: using lethal force on behalf of the state while minimizing collateral harms to civilians and friendly forces.[24]

In what follows, we investigate the ethics of military enhancement research, beginning with a brief comment on the issue of defining "enhancement" and then outlining existing rules governing testing in the military. What follows is a critical analysis of justifying research in the context of military enhancement, targeting two specific issues. We deal first with the issue of motivating the case for human subjects research on military enhancements, addressing two issues: (a) a compelling military need and (b) a strategic dominance. We argue that these justifications provide poor reasons. We then turn to the issue of coercion and exploitation and argue that current accounts of military research do not sufficiently account for the possibility that enhancement could be exploitative or coercive. We finish with a suggestion for a different idea about the ethics of military enhancement grounded in harm reduction: research might be the least-worst option available given military culture and the rise of enhancements in other domains.

Definitional and Regulatory Issues: Enhancement and Human Subjects Research

Concerns about what enhancement is, and what its moral status might be, are at this point somewhat a cottage industry in bioethics.[25] A conventional way of understanding enhancement, as distinct from therapy, is that an enhancement constitutes the increase of some living creature's[26] capacities beyond a statistical norm. Enhancement is often further described in terms of medical necessity or its lack. Although vaccines or certain prostheses such as those used by Paralympians might enhance us beyond

certain statistical norms (e.g., resistance to a disease), they are more controversial candidates for "enhancement" as they tend to serve some important medical needs.[27]

We will not engage substantively in the broader enhancement debate here. On the one hand, wading into that live debate would take us too far afield. On the other, military enhancement is arguably less controversially "enhancement" than just about anything else discussed in the broader enhancement literature. Warfighters, to begin, are typically engaged in very physically and cognitively demanding work, and thus are already pushing up against (if not surpassing) statistical physical norms. So-called enhancements of warfighters are thus unambiguously extensions of existing human performance for a group who are already extended beyond statistical norms.[28]

Moreover, warfighters are not subject to these interventions as a precondition of their service. Where military medicine is predominantly concerned with returning serving personnel to active duty, enhancement is the practice of conferring desirable traits on warfighters who can already do their job on par with their peers. Enhancement here is a task of optimization of a person to a role where that person is, either individually or as part of a group, sufficient to carry out their task.

Like most discussions of enhancement, military enhancement is a matter of degree. Advanced prostheses may return a warfighter to duty in the future or conceivably return them to service stronger than they were before. In Marvel's Iron Man 2, protagonist Tony Stark foreshadows this by referring to his mechanized suit of armor as a "high-tech prosthesis" while at a Senate inquiry. And indeed, the DARPA program that seeks to master brain-computer interfaces, ultimately, combat operations, is the Revolutionizing Prostheses project. So, it is possible in principle that it would be desirable for any warfighters qua warfighters to have prosthetics just in case they are stronger than they would be without them—and an amputee warfighter might one day be enhanced relative to a nonamputee warfighter.

Nonetheless, the distinction remains valuable in terms of thinking about the differential risks that arise in the context of using intervention as a therapy versus an enhancement. In the context of a therapy, a warfighter who has sustained a loss of a limb might be faced with the following options:

1. Receive no prosthesis and retire from the service or be assigned to noncombat duties
2. Receive a prosthesis but have it perform insufficiently well to return to duty and also cause side effects
3. Receive a prosthesis and have it perform sufficiently well to return to duty, potentially with some detrimental side effects
4. Receive a prosthesis and have it perform better than the warfighter's original capacities, potentially with some detrimental side effects

In the case of enhancement, items 2–4 might be the same, but item 1 would read:

1. Receive no prosthesis and continue to serve.

If we take the purpose of these therapeutic options in military service to be either (a) to restore a warfighter to their biostatistical normal rate, or (b) to be able to perform their duties, the ranking for one's options in the case of prosthesis qua therapeutic option appear to be $1 < 2 < 3 < 4$ (assuming side effects are not debilitating). For the case of enhancement, however, the ranking would likely look more like $2 < 3 < 1' < 4$ in the case of a prosthesis with some side effects, or $2 < 3 \sim 1' < 4$ in case of a prosthesis with little to no side effects. Therapies and enhancements differ in terms of the kinds of risks they present, in part, because the baseline at which individuals begin differs. Thus, at least, in these prototypical cases, the weight of the justifications available to us both in the testing and development of enhancements differ from therapeutic interventions.

The DOD does not currently have a policy on enhancement research, but it does have policies around human subjects research more broadly. The DOD subscribes to the Common Rule and its subparts and has implemented the Final Rule from the 2011 Advance notice of proposed rulemaking (ANPRM). Moreover, DOD Directive 3216.02 establishes a series of additional oversight mechanisms specifically for DOD funded research. These mechanisms include a medical monitor that may be required to assess

any component of the study to ensure patient safety, forbidding the presence of officers and noncommissioned officers in subject solicitation and recruitment, and mandating the presence of an ombudsman to ensure that when groups of participants are being recruited together, they do so voluntarily. The Directive also assigns the responsibility for human subjects' research to the Under-Secretary of Defense for Research and Engineering, and authorizes the Human Systems Directorate supervision of the DOD Office of Human Research Protections.

Importantly, not all experimental technologies subject to research are traditionally understood. Field-testing in place of (otherwise permissible) experimental research is common and less clearly subject to regulation. The Uniform Code of Military Justice requires that warfighters accept medical interventions that make them fit for duty, and the U.S. government has shown a tendency to defer to commanders in a combat situation as to whether they think some treatment is likely to do more harm than good, even if unproven.[29] In the context of experimental and potentially irreversible changes to the physiology and neuropsychology of warfighters, this poses ethical issues regarding the risks to which warfighters can be justifiably exposed. Moreover, it threatens to exacerbate worries of coercion: If commanders in combat situations can order the implementation of enhancements, their subordinates are unable to refuse.

Issue 1: Therapeutic Needs

Enhancement research poses a preliminary issue because there is no compelling medical justification for the kinds of intervention about which we are concerned. Enhancements in the military do not treat clinical illness or otherwise restore lost function, the definitional caveats above notwithstanding.

This need not entail, however, that enhancement research is impermissible, as some have argued.[30] A strong institutional need can justify research even in the absence of immediate clinical needs. Public health research, for example, might seek to advance knowledge of a particular risk factor for disease—or even good health—in a way that does not immediately fill a compelling therapeutic need. More controversially, recent discussion of human challenge studies for potential pandemic diseases has raised the possibility that researchers might induce disease in a healthy person for the purposes of validating a therapeutic during, say, a disease pandemic.[31]

What, then, is the institutional or social value of military enhancement research? The frequent reply, for any scientific discipline in which the military is engaged, is either (a) to respond to some compelling need in normal operations,[32] or (b) strategic dominance.[33]

Modafinil is a paradigm example of the former. Warfighters can be required to maintain alertness and executive functions over very long combat missions, sometimes going for days without sleep. Indeed, lapses in wakefulness can be deadly for individuals and their comrades. Modafinil represents an advance over the problematic use of (for example) amphetamines, which have considerable side effects including the potential for addiction.[34]

An example of (b) would be a brain-computer interface (BCI) for use piloting drones, allowing drones to be operated through a direct neural connection.[35] There is no medical need for drone operators to communicate with their machines through a BCI; traditional instrumentation is just fine. However, in a future world in which drone warfare, and in particular multi-party drone warfare, is the norm, a BCI might provide a strong strategic advantage over the enemy.

That might be attractive or even desirable from a strategic perspective. It may even promote some kind of ethically salient value such as well-being if it leads to wars that (at least for those at home) harm fewer soldiers, cost less money, or are over faster. But it is hardly compelling. Nothing about these operations requires this kind of advantage. In point of fact, drone operators are some of the safest "combatants"[36]—at least, from enemy combatants—on the planets. They are traditionally ensconced in operations centers in U.S. soil and their targets are thousands of miles distant.

So, it is not clear that, all other things being equal, we would be justified in subjecting non-injured individuals to an experimental BCI based on an uncompelling military need. In military ethics parlance, this kind of experiment is neither necessary (in the sense that it is the means to fulfill an aim vital to the accomplishment of a just military goal) nor proportionate (because the goal can be plausibly

accomplished at much less risk to the warfighter by, e.g., not implanting a chip in their brain). Enhancement research that relies on necessity as a justification falls prey to the limits of military necessity, which are quite high.

It might be replied that this is a reductio of sorts. If we took this logic seriously, U.S. troops would only require AK-47s and civilian clothes to achieve parity with their enemy, a critic might say. They may even require less than that, given how many of them there are—some 1 million active and reserve personnel. A less hyperbolic version might note that even the greatest state military threats to the United States are typically the U.S. technological inferiors.

The point, however, is not that strict parity is required. Nor is it the case that the argument applies to all military technologies. The compelling need argument need only apply to innovation requirements exposing individuals to risk through human experimentation for the purpose of human enhancement. It may not be necessary, for example, in justifying building a new Tomahawk missile.[37] But by imposing on warfighters a BCI when they do not need it, say, to control a modern prosthetic,[38] we need to cite a compelling current or future strategic need.

Here it is critical to ask *how likely* a future need must be to satisfy necessity. For some theorists, imminence is internal to necessity such that necessity is satisfied only if imminence is, and imminence admits various interpretations.[39] We divide these broadly into *epistemic* interpretations and *temporal* interpretations. According to the former, X is imminent just in case X is reasonably likely to occur.[40] According to the latter, X is imminent just in case X is temporally soon to occur.[41] As we see matters, many enhancement technologies are imminently future needs under *both* conceptions of imminence. That is, they are reasonably likely to be needed and will soon be needed.

An example of an enhancement that arguably meets this criterion is the creation of synthetic microbial technology that processes ingested and inhaled toxins in the event of biological or chemical weapons exposure. Transnational terrorist networks and other states have at times developed chemical and biological weapons with an intended use of U.S. targets, including military targets. ISIS, when still active, famously attempted to recruit captured scientists into a biological weapons program, and Al-Qaeda Arabian Peninsula has expressed their desire to construct biological weapons.[42] There is some evidence, albeit primarily from assertions in memorandums released by the government of South Korea, that North Korea may be attempting to build biological weapons in addition to its current nuclear arsenal.[43] Given that biological weapons can be almost impossible to detect and the broad public health and strategic issues associated with a biological attack (especially an infectious attack), seeking to enhance and thus test enhancements on a soldier might be justified on these anticipatory grounds.

Note that this is a particular and specific kind of justification for a particular class of enhancement. Against the strong view that no military encounters count as compelling, it illustrates that what counts as compelling requires a higher burden of proof than mere desirability. This property of "compellingness," moreover, is continuous: Things can be more or less compelling in nature. What counts as compelling is prone to a serious set of interpretation problems depending on the actor, a problem to which we turn in the next section.

The second reason given for technological innovation by American scholars, especially and including the case of enhancement, is strategic dominance. By strategic dominance, we mean that, in some contexts, capacity and readiness to show overwhelming force, or to at least convince a potential belligerent that there is a very high cost to be borne relative to the potential gains of a sustained attack, is instrumentally rational relative to discouraging initial or further engagements.[44] Enhancement research could thus be justified on the basis of demonstrating one's strategic power—that one's forces are better prepared and ultimately better engineered for the kinds of engagement in which a belligerent would encounter them.

Importantly, this argument has also been applied to technologies that might be plausibly used in offensive ways but are researched for purely "defensive" purposes. The creation of new biological agent delivery mechanisms, for example, has been defended as defensive research because it allows the United States to demonstrate its knowledge of the delivery system and thus better defend against it.[45]

A central issue for the United States, the subject of this analysis so far, is that in almost all cases, strategic dominance is overdetermined: American supremacy in armed conflict is, at least in the near-to-

mid-term, not only assured, but also multiply so. The United States currently has the most advanced, most expensive military on the planet. So expensive is this military that it is greater than the sum of the next 11 largest commitments of military spending, a list including many of its allies.[46] The United States currently has no strategic equal. It is strategically dominant and stands to be so for the foreseeable future.

Strategic dominance in a multi-polar nuclear war is even less convincing than enhancement research to fulfill a compelling military need. The United States possesses more than 6,800 active nuclear warheads, of which 1,800 are deployed at any time, an arsenal that is less (albeit better maintained) in the number of warheads than the Russian Federation. It is an order of magnitude more than the next largest non-NATO country after Russia: China, with 270 warheads. The idea that strategic dominance goals are met by any other modality, much less human enhancement, is laughable. Arguing for strategic dominance, again, may be a more plausible justification for other military technological development, but not as a prima facie justification for enhancement research on warfighters.

Strategists could respond in two ways. To the first charge of strategic dominance, they can note that while currently strategic dominance exists, it may not be in the future, and further that in a range of counterfactual futures this may involve warfighter enhancement. To the second, they can note that nuclear weapons are necessarily coarse grained, and that we might want available military options that do not entail nuclear holocaust—including, potentially, enhancement. These lead us to a range of options in which enhancement may be important for future strategic dominance that obviates the need for nuclear weapons.

In response to this, we can note two things. To the first objection, we note that even if warfighter enhancement is sometimes justified on strategic dominance grounds, it must be in particular ways. It must be a future world in which something about our strategic landscape has changed so drastically that it requires enhanced warfighters. Perhaps a BCI is justified for what DARPA refers to as "human machine hybridization" with the purpose of humans and artificial intelligence working together to address issues of cybersecurity in a near future war in which cyberattacks are capable of undermining command and control of conventional war to the point that strategic dominance is threatened.

In the second case, we could envisage either a world without nuclear weapons (which seems desirable), or a world in which armed conflict is necessary but in cases where nuclear weapons are not considered a strategic deterrent or a plausible option for action. We take that one of the chief reasons to possess nuclear weapons is the threat of their use against conventional or unconventional attacks on home soil: indeed, the United States maintains a posture that a biological attack (of considerably lower magnitude than a nuclear attack) would earn disproportionate nuclear weapons from a belligerent. Of course, some engagements are not directly about dominance at all, for example, enhancements that increase the likelihood of saving one's fellow combatants or proximal civilians. But such engagements then fall prey to condition (a): a compelling need in normal operations.

Issue 2: Coercion and Exploitation

One possible avenue to salvage these initial justifications is to deny that the prima facie justification is necessary. After all, we might complain that if an individual gives informed consent for sufficiently weighty personal reasons, there are no reasons to disallow individuals from participating in research.[47] From this, we might think that the only thing limiting enhancement research warfighters is the availability or dearth of an available sample.

The typical response to laissez-faire approaches to medical research is to mention coercion and exploitation. Indeed, a popular albeit contested raison d'être of research ethics regulations is the possibility of exploitation.[48] Although the Common Rule recognizes "vulnerable populations," warfighters are not explicitly considered as vulnerable to exploitation or coercion in the Common Rule.[49]

Nevertheless, there are clear and particular circumstances in which warfighters are subject to experimental interventions that are, on their face, worthy of concern. The first is that even given the existence of regulatory apparatus designed to avoid human subjects abuses, warfighters are often subjected to untested intervention as part of their marching orders. In the case of AVIP (the anthrax

vaccine), the DOD had previously argued in military courts that soldiers refusing to accept the vaccine were violating orders. Military courts routinely suppressed evidence that soldiers were denied access to information assessing the vaccine's risks, saying such information was irrelevant to the "central" question of whether they violated orders.[50]

DOD has attempted to address the issue of coercion through procedural means. In the main, it makes use of ombudsmen or medical monitors at various stages of the research process. It also requires central coordination of human research activities at an agency level. By requiring allegedly independent observers, the forces that might lead to coercion can be countered or mitigated.

This is insufficient for a few reasons. The first is that it is not clear what "independence" constitutes. It almost certainly does not mean independence from DOD. This is a problem in the context of attempting to undermine potentially coercive or exploitative forces, as only requiring independence from the research project and not the larger strategic aims of the organization misunderstand the problem. In the context of human subjects research including enhancement research, it is arguably the overall strategic aims of the organization playing the strongest role in unduly motivating participants. This is particularly acute within the parts of DOD that do the lion's share of enhancement or enhancement-adjacent (i.e., research that might one day lead to enhancement research) research. DARPA's specific mission is "research and development (R&D) organization in DOD with a primary responsibility of maintaining U.S. technological superiority over [America's] adversaries."[51] Research and Engineering are likewise to play a role here. Lockheed Martin's Steven Walker serves as the Chief Technology Officer (CTO) of the Department and is tasked with the imperative mission of ensuring continuous advancement of technology and Innovation within the DOD enterprise."[52] Their central and stated goal within the organization of the DOD is to achieve technological innovation.

The implications for this in terms of policy and advisement are compounded by the lack of medical ethics capacity in leadership roles that supervise enhancement research. The 2018 head R&E and its subdivision that oversees human subjects research are a mathematician who was a VP at Raytheon, and a physicist, respectively. Responsibility for coordinating and nominating an oversight committee falls to individuals unlikely to possess the relevant expertise in clinical research. This does not disqualify them from leadership over DOD technology development more generally, but it is a concern in cases where that technology development imposes risks on others and requires sophisticated theoretical and clinical ethical competency or expertise.

A second issue of exploitation exists, however, that has yet to be discussed in the literature. Warfighters, and in particular those in Special Operations Forces, are not shy about admitting their use of any and all available means to give them an advantage in battle. As one former operator told one of us, "This is not the NCAA. If I can take something that helps me get over a torn ACL, or makes me kill the bad guys better, I'll take it, no question."[53] Warfighters are by and large not reluctant adopters of technology; indeed, they are very, very eager adopters.

The problem here is that much like civilians with underserved medical needs, others can exploit warfighter's eagerness. The others of which we should be particularly concerned, moreover, are the organization these individuals serve. If all warfighters want is (to use the 20-year slogan of the Army) to "be all they can be," then the U.S. DOD is a particularly conflicted purveyor of enhancements. This is compounded by the loyalty warfighters may have to the institution of national security, a loyalty that in the past has been exploited to catastrophic effect.[54]

A reply to this concern might be that there is nothing wrong with eagerness or loyalty as long as such eagerness or willingness is well-placed and not exploited by the relevant authorities. Yet there are strong prima facie reasons to believe that this willingness is exploited by the services. Soldiers have been recommended to not carry more than 50 lb of equipment, but the average soldier carries close to 100 lb on daily operations. Approximately 33% of all medical evacuations from combat areas are from musculoskeletal injuries brought about by excessive weight.[55] The military consistently demonstrates that the welfare of individuals is secondary to force effectiveness. We have little reason to believe that this is likely to be different in conducting experiments generally or field-testing experimental enhancements specifically.

Enhancement Research and the Least-Worst Option

Military enhancements struggle to satisfy standard reasons given for human experimentation. Moreover, a laissez-faire approach to human experimentation is ethically problematic because of the kinds of influences warfighters are subject to, which may lead to exploitation and/or coercion. In this concluding section, we introduce a case for continuing human experimentation on enhancements in the military, following the idea of a least-worst option.

The argument follows like so. Even if we were to discontinue all proposed or future human enhancement research in the military, human enhancement is unlikely to stop. In particular, nonclinical psychotropic use by civilians will almost certainly continue, and has been reported to be increasing among young people and especially college students. The use of transcranial direct stimulation, in which electrodes are applied to a person's head and an electric current is passed between them, is also on the rise in "do-it-yourself" (DIY) communities.[56]

If the enhancement is increasing everywhere, then warfighters will get their hands on it. They may do so as civilians, while on base in the United States, or from family or friends while abroad. They will use these enhancements—this is indeed not the NCAA, and warfighters acutely attuned to the risks of their profession will attempt to gain whatever edge they can.

Given these realities, a few policy options present themselves:

1. Conduct little to no enhancement research, only which is justified in a compelling military need or for (a narrow interpretation of) strategic dominance
2. Conduct enhancement research in the domain of permissible civilian enhancements
3. Conduct broad sets of enhancement research

The last pages stand as an argument against (3). But (2) may be preferable to (1). Research under (2) might not be permissibly pursued exclusively as military enhancement research. But, given that some enhancements are dual-use, there is a strong possibility that these enhancements start out in civilian life and are later adopted by warfighters as enhancements—as part of official doctrine, or as part of soldiers "be[ing] all [they] can be." In this case, it may be better to conduct experiments to determine the safety and efficacy of those potential enhancements, rather than allow them to go used but unvalidated.

We call this the Least-Worst Argument. It would arguably be good if people did not pursue enhancement research absent compelling evidence and a genuine need. But that just is not the case—an enhancement arms race is imminent, if not already upon us.[57] Thus, a pivot from ideal to non-ideal bioethical theory is called for. Contrary to many perspectives in contexts where the future is overtaking us,[58] the laissez-faire approach is neither our only nor our best option. Rather, taking seriously the existing submarket for enhancement and attempting to validate it is better than either excess restriction or excess permission.

An easy objection here is that this will only push us further toward a sort of creeping laissez-faire. But that is less obvious than it appears. It is true that by validating existing attempted enhancements, we run the risk of sending the signal that any enhancement is permissible, and that as long as enough people want to adopt these enhancements, we are compelled to confer them legitimacy through experimental testing. But two competing prospects counterbalance this concern. The first is that if we do not validate, many people could be afflicted with side effects from inappropriate use of medical technologies or interactions with other interventions. The second is that in validating these enhancements, we may suppress a market by showing the limited or nonexistent efficacy of these interventions as enhancements and thereby discouraging harmful "black market" experimentation.

Thus far, this paper has remained agnostic about the question of whether we ought to enhance ourselves simpliciter. The Least-Worst Argument preserves this agnosticism. Nowhere here is there an argument that we should not enhance ourselves. Rather, the argument is that we ought to take seriously that subjecting warfighters to experimental enhancements is only justified in certain cases. Research in (2) looks more like conventional medical research or even public health research, fulfilling an important institutional aim: protecting warfighters from doing themselves harm by applying untested and

potentially dangerous interventions to their bodies. In doing so, it satisfies (albeit in a roundabout way) a requirement for ethical research.

Conclusion

Herein, we have argued that two important justifications for military enhancement research (i.e., compelling military needs and strategic dominance) fail in many cases to provide sufficient reason to conduct enhancement research. Laissez-faire approaches fail due to the strong structural forces in military life that leave open the possibility, even with current regulations, of exploitation and coercion. We argue that some enhancement research might be justified, however, if and because research on these interventions is the least-worst option given their likely use.

In this argument, we have neglected a couple of other arguments for the sake of space. There are future concerns about enhancements, not least of which who monitors an enhancement after a warfighter retires from active duty or what responsibility the military has to maintain the quality of life for warfighters who have been (or remain) enhanced. These future-looking problems are pressing in the context of enhancement but are not necessarily issues for enhancement qua research. Consideration of those questions belongs to future papers.

Acknowledgments. The authors were supported by the U.S. Air Force Office of Scientific Research (FA9550-21-1-0142). NGE was also supported by the Greenwall Foundation Faculty Scholars Program and the National Science Foundation (1734521). No sponsors had any role in the conception, analysis, or writing of this article. NGE would like to thank Danielle Wenner, Alex John London, Charles Weijer, David DeGrazia, Spencer Phillips Hey, Laura Specker Sullivan, Stephanie Morain, Rebecca Dresser, and Ruth Macklin for comments on an earlier draft presented at the 2018 Center for Ethics and Policy Workshop at Carnegie Mellon University.

Notes

1. Kamienski L. *Shooting Up*. Oxford: Oxford University Press; 2016.
2. National Research Council.*Caffeine for the Sustainment of Mental Task Performance: Formulations for Military Operations*. Washington, D.C.: National Academies Press (US); 2001.
3. Moreno JD. *Mind Wars*. N.Y., New York: Bellevue Literary Press; 2012.
4. See note 3,. Moreno, 2012.
5. Evans NG, Moreno JD. Neuroethics and policy at the national security interface. In: Racine E, Aspler J, eds. *Debates About Neuroethics*. Switzerland: Springer; 2017:141–60.
6. Buniak L, Darragh M, Giordano J. A four-part working bibliography of neuroethics: Part 1: Overview and reviews – defining and describing the field and its practices. *Philosophy, Ethics, and Humanities in Medicine: PEHM* 2014;9(1):**9**. doi:10.1186/1747-5341-9-9.
7. Repantis D, Schlattmann P, Laisney O, Heuser I. Modafinil and methylphenidate for neuroenhancement in healthy individuals: A systematic review. *Pharmacological Research* 2010;**62**(3):187–206. doi:10.1016/j.phrs.2010.04.002
8. Tennison MN, Moreno JD. Neuroscience, ethics, and national security: The state of the art. *PLoS Biology* 2012;**10**(3):e1001289. doi:10.1371/journal.pbio.1001289.
9. U.S. Department of Defense. *Protection of human subjects and adherence to ethical standards in DoD-supported research*; Published October 2018; available at https://www.esd.whs.mil/Portals/54/Documents/DD/issuances/dodi/321602p.pdf (accessed 13 January 2022).
10. Spence DL. Ensuring respect for persons when recruiting junior enlisted personnel for research. *Military Medicine* 2007;**172**(3):250–53. doi:10.7205/MILMED.172.3.250; McManus J. Informed consent and ethical issues in military medical research. *Academic Emergency Medicine* 2005;**12**(11):1120–6. doi:10.1197/j.aem.2005.05.037.

11. Parasidis E. Classifying military personnel as a vulnerable population. In: Cohen IG, Fernandez Lynch H, eds. *Human Subjects Research Regulation*. Cambridge, Massachusetts: The MIT Press; 2014:65–78. doi:10.7551/mitpress/9780262027465.003.0007.
12. Annas CL, Annas GJ. Enhancing the fighting force: Medical research on American soldiers. *J Contemp Health Law Policy* 2009;**25**(2):283–308.
13. In conversation with a participant at a DOD SOCOM Event under the Chatham House Rule, November 2018.
14. Groopman J. Eyes Wide Open. *The New Yorker*. Published 26 November 2001; available at https://www.newyorker.com/magazine/2001/12/03/eyes-wide-open (accessed 13 January 2022).
15. Moreno JD. *Undue Risk*. London: Routledge; 2013.
16. Welsome E. *The Plutonium Files*. London: Delta; 2010.
17. *Rempfer v. Sharfstein*, 583 F.3d 860 (DC Cir. 2009)
18. See note 11., Parasidis 2014.
19. Gronvall GK. US competitiveness in synthetic biology. *Health Security* 2015;**13**(6):378–89. doi:10.1089/hs.2015.0046; Giordano J, Forsythe C, Olds J. Neuroscience, neurotechnology, and national security: The need for preparedness and an ethics of responsible action. *AJOB Neuroscience* 2010;**1**(2):35–6. doi:10.1080/21507741003699397.
20. Evans NG, Majumder MS, Smith TC. *Ebola's Message*. Cambridge, Massachusetts: MIT Press; 2016: chapter 13–15; Evans NG. COVID-19: the ethics of clinical research in quarantine. *BMJ* 2020;369. doi:10.1136/bmj.m2060; Evans NG. Human infection challenge studies: A test for the social value criterion of research ethics. *mSphere* 2020;**5**(4). doi:10.1128/mSphere.00669-20; Evans NG, Hills K, Levine AC. How should the WHO guide access and benefit sharing during infectious disease outbreaks? *AMA Journal of Ethics* 2020;**22**(1):28–35. doi:10.1001/amajethics.2020.28.
21. Mehlman MJ, Berg JW. Human subjects protections in biomedical enhancement research: Assessing risk and benefit and obtaining informed consent. *The Journal of Law, Medicine & Ethics* 2008;**36** (3):546–59. doi:10.1111/j.1748-720x.2008.303.x; Mehlman MJ, Berg JW, Juengst ET, Kodish E. Ethical and legal issues in enhancement research on human subjects. *Cambridge Quarterly of Healthcare Ethics: CQ: the International Journal of Healthcare Ethics Committees* 2011;**20** (1):30–45. doi:10.1017/S0963180110000605; Lev O, Miller FG, Emanuel EJ. The ethics of research on enhancement interventions. *Kennedy Institute of Ethics Journal* 2010;**20**(2):101–13. doi:10.1353/ken.0.0314.
22. Maxwell J, Mehlman TYL. Ethical, legal, social, and policy issues in the use of genomic technology by the U.S. military. *Journal of Law and the Biosciences* 2014;**1**(3):244–80. doi:10.1093/jlb/lsu021; Gross ML. Military medical research ethics: Investigational drugs, clinical trials and enhancement. In: MacKay D, Iltis A, eds. *Oxford Handbook of Research Ethics.* researchgate.net; 2019:1–17; Evans, Nicholas G. *The Ethics of Neuroscience and National Security.* London: Routledge; 2021.
23. Walzer M. *Just and Unjust Wars*. N.Y., New York: Basic Books; 2015.
24. We anticipate the following objection: Enhancements that cause soldiers to act empathetically or cause minimal harm to enemy combatants might be *easier* to justify, as they improve the discriminating abilities of soldiers. However, this objection makes the dubious assumption that we know ex ante how particular enhancements will work. Our paper concerns the permissibility of initiating enhancement research, whereas the objector assumes we have results in hand.
25. Savulescu J. Procreative beneficence: Why we should select the best children. *Bioethics* 2001;**15**(5–6):413–26. doi:10.1111/1467-8519.00251; Sparrow R. Human enhancement and sexual dimorphism. *Bioethics* 2012;26(9):464–75. doi:10.1111/j.1467-8519.2011.01884.x.
26. We can enhance, and "disenhance," nonhuman animals, though I will not discuss this further here. See note 1, Kamienski 2016. Henschke A. Making sense of animal disenhancement. *NanoEthics* 2012;6(1):55–64. doi:10.1007/s11569-012-0140-8.
27. Evans NG, Moreno J. Children of capital: Eugenics in the world of private biotechnology. *Ethics in Biology, Engineering and Medicine: An International Journal* 2015;**6**(3–4):285–97. doi:10.1615/EthicsBiologyEngMed.2016016594; Evans NG, Reynolds JM, Johnson KR. Moving through capacity space: Mapping disability and enhancement. *Journal of Medical Ethics* 2021;47:748–55.

28. See note 27, Evans et al. 2021.
29. See note 8, Tennison and Moreno, 2012.
30. Daniels N. Can anyone really be talking about ethically modifying human nature. In: Savulescu J, Bostrom N, eds. *Human Enhancement*. Oxford: Oxford University Press; 2009:25–42; Juengst ET, Binstock RH, Mehlman M, Post SG, Whitehouse P. Biogerontology, "anti-aging medicine," and the challenges of human enhancement. *The Hastings Center Report* 2003;**33**(4):21–30. doi:10.2307/3528377.
31. See note 20, Evans 2020.
32. Mehlman MJ, Lin P, Abney K. *Enhanced Warfighters: Risk, Ethics, and Policy*. Calpoly Saint Luis Obispo; 2013. http://ethics.calpoly.edu/greenwall_report.pdf (accessed 13 January 2022).
33. Giordano J, Forsythe C, Olds J. Neuroscience, neurotechnology, and national security: The need for preparedness and an ethics of responsible action. *AJOB Neuroscience* 2010;**1**(2):35–6. doi:10.1080/21507741003699397. See also note 22, Evans 2021, at chap. 15.
34. See note 1, Kamienski 2016.
35. Evans NG. Emerging military technologies: A case study in neurowarfare. In: Tripodi P, Wolfendale J, eds. *New Wars and New Soldiers: Military Ethics in the Contemporary World.* Ashgate; 2011:105–16; Krishnan A. *Military Neuroscience and the Coming Age of Neurowarfare (Hardback)*. London: Routledge; 2016.
36. Enemark C. Unmanned drones and the ethics of war. In: Allhoff F, Evans NG, Henschke A, eds. *Routledge Companion to Ethics and War.* philpapers.org; 2013:327–38.
37. I have the intuition that it is there, as well, but an argument there would require defeating arguments around the role of state prerogatives and national security in armed conflict, which I will set aside here for the sake of brevity.
38. Degenhart AD, Hiremath SV, Yang Y, Foldes S, Collinger JL, Boninger M, *et al.* Remapping cortical modulation for electrocorticographic brain-computer interfaces: A somatotopy-based approach in individuals with upper-limb paralysis. *Journal of Neural Engineering* 2018;**15**(2):026021. doi:10.1088/1741-2552/aa9bfb.
39. Rodin D. *War and Self-Defense*. Oxford: Clarendon Press; 2005:41.
40. Rodin accepts this view. See note 39, Rodin 2005.
41. This interpretation is favored by Marcia Baron, who argues we should reject the imminence requirement for permissible self-defense. See Baron M. Self-defense: The imminence requirement. In: *Oxford Studies in Philosophy of Law.* Oxford: Oxford University Press; 2011:228–66.
42. Evans NG. Ebola: From public health crisis to national security threat. In: Lentzos F, ed. *Biological Threats in the 21st Century*. London: Imperial College Press; 2016:277–92. doi:10.1142/9781783269488_0017.
43. Though CF, Horowitz MC, Narang N. Poor man's atomic bomb? Exploring the relationship between "weapons of mass destruction." *Journal of Conflict Resolution* 2014;**58**(3):509–35. doi:10.1177/0022002713509049.
44. Kühn U. Institutional resilience, deterrence and the transition to zero nuclear weapons. *Security and Human Rights* 2015;**26**(2–4):262–80. doi:10.1163/18750230-02602002; Koblentz GD. Regime security: A new theory for understanding the proliferation of chemical and biological weapons. *Contemporary Security Policy* 2013;34(3):501–25. doi:10.1080/13523260.2013.842298.
45. Enemark C. United States biodefense, international law, and the problem of intent. *Politics and the Life Sciences* 2005;**24**(1–2):32–42. doi:10.2990/1471-5457(2005)24[32:usbila]2.0.co;2.
46. Mehta A. The world spent almost $2 trillion on defense in 2020. *Defense News.* Published April 26, 2021; available at. https://www.defensenews.com/global/2021/04/26/the-world-spent-almost-2-trillion-on-defense-in-2020/ (accessed 10 November 2021).
47. For defenses, see Chappell RY, Singer P. Pandemic ethics: The case for risky research. *Research Ethics.* Published online June 2, 2020:1747016120931920. doi:10.1177/1747016120931920; Wertheimer A. The social value requirement reconsidered. *Bioethics* 2015;29(5):301–308. doi:10.1111/bioe.12128.

48. Emanuel EJ, Wendler D, Grady C. What Makes Clinical Research Ethical? JAMA. 2000;**283**(20):2701–2711. doi:10.1001/jama.283.20.2701.
49. We will not spend time on what constitutes coercion versus exploitation. Like "enhancement," wading into the debate about whether these terms are coherent or useful takes me too far afield and has been covered in detail elsewhere. Moreover, it is not clear that in the context of this paper there is a particular utility in attempting to carve a neat distinction.
50. Parasidis E. Justice and beneficence in military medicine and research. *Houston Journal of Health Law and Policy* 2012;**73**(723–793); available at https://heinonline.org/hol-cgi-bin/get_pdf.cgi?handle=hein.journals/ohslj73&section=25 (accessed 13 January 2022).
51. DOD Directive 5134.10, September 2017.
52. U.S. Department of Defense. *About – DoD Research & Engineering*. Published 2022; available at https://www.cto.mil/about/ (accessed 13 January 2022).
53. Personal communication with participant at a meeting at US SOCOM, November 2017. Reported under the Chatham House Rule.
54. Henschke A, Evans NG. Winning Well by Fighting Well. International Journal of Applied Philosophy. 2012;**26**(2):149–163. doi:10.5840/ijap201226212.
55. Cohen SP, Brown C, Kurihara C, Plunkett A, Nguyen C, Strassels SA. Diagnoses and factors associated with medical evacuation and return to duty for service members participating in Operation Iraqi Freedom or Operation Enduring Freedom: a prospective cohort study. The Lancet. 2010;**375**(9711):301–309. doi:10.1016/S0140-6736(09)61797-9.
56. Wexler A. The practices of do-it-yourself brain stimulation: implications for ethical considerations and regulatory proposals. Journal of Medical Ethics. 2016;**42**(4):211–215. doi:10.1136/medethics-2015-102704.
57. Arguably this has been going on for some time, if we take seriously the idea that private education and tutors are nonmedical enhancements of a kind. See note 27, Evans and Moreno 2015.
58. See note 19, Gronvall, 2015.

Cite this article: Hereth B and Evans N (2022). Can We Justify Military Enhancements? Some Yes, Most No. *Cambridge Quarterly of Healthcare Ethics* 31: 557–569, doi:10.1017/S0963180122000421