

Overview of Outcome Data of Potential Meditation Training for Soldier Resilience

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ABSTRACT In order to identify potential training to enhance comprehensive soldier fitness, this analysis searched MEDLINE via PubMed and elsewhere for 33 reasonably significant modalities, screening over 11,500 articles for relevance regarding soldier resilience. Evaluation of modalities that are exclusively educational or cognitive/behavioral in nature is deferred. Using the volume and quality of research over 40 parameters distributed among the five domains of resilience (physical, emotional, spiritual, social, and family life), these data allow culling of most of the meditative modalities and discrimination among the remaining techniques. The resulting order of merit is Transcendental Meditation, mindfulness, and progressive muscle relaxation. Transcendental Meditation, mindfulness, and progressive muscle relaxation, in that order, have the most supporting data. Fortunately, they also represent a cross section of the domain of techniques regarded as meditation, stress management, or relaxation, with three very different mechanisms of action. They are suitable potential options for improving soldier resilience.

INTRODUCTION

The high incidence of post-traumatic stress disorder (PTSD), suicides, and other adverse events in returning Operation Iraqi Freedom/Operation Endurance Freedom veterans^{1,2} has made soldier (and family) resilience, defined as “the ability to meet challenges and to bounce back after difficult experiences,”³ a priority for the Army. The mandatory Comprehensive Soldier Fitness (CSF) program requires soldiers to self-administer the Global Assessment Tool (GAT) and then segue online into Resilience Training (RT) currently comprising vignettes and didactic material. As the CSF is new and has as yet no clear “gold standard” metric for resilience in soldiers (nor does most published research⁴), data prospectively confirming the efficacy of current RT are not yet available.^{5,6} Modalities for future training are in development. In years to come, as soldiers continue to take the GAT and then select training, it is appropriate that the training opportunities would not be limited to a recapitulation of perhaps previously mastered educational material and would include tools for development of high-level wellness and performance.

Decisions regarding such training will need to be based upon inferences from the body of research that does exist regarding similar or related areas in the field of self-development. This analysis assumes that there are direct relationships between resilience and parameters such as enhanced physical health, freedom from anxiety and distress, improved social integration and better family and workplace relationships, decreased substance abuse, and the other metrics reviewed herein. It further assumes that any training added to current RT will be evidence-based and amenable to execution in an operational environment.

All such tools or activities should be portable and inconspicuous (as practices that invite stares are unlikely to be acceptable to soldiers). For example, although no one should

expect soldiers to practice eyes closed techniques while they need to pay attention to their environment, any such technique should be possible to practice in “downtime” even while wearing cumbersome equipment, perhaps while in a vehicle, airframe, or austere setting. It should not require privacy, the cooperation or service of another person, nor further in-theater support or training. The modality should produce desired perceptible results promptly; training to standard should not add an undue burden of training time.

Interpreting data from the fields of cognitively oriented self-development and resilience is a challenge. MEDLINE searches for resilience and self-development do not reveal many controlled studies.^{7,8} This article focuses on the arena of eyes closed seated meditative techniques, widely known and studied as “stress management” or “relaxation techniques.”

Interpreting data from meditation and relaxation also is not simple. Although experts in their fields (including abbots of monasteries and leaders of ashrams) readily distinguish the procedures, objects, contents, and goals of their meditation practices,⁹ many researchers are indiscriminate in combining data from a number of different techniques; the value of their conclusions is at best unclear.^{10–12} In fairness to those authors, some meditative or relaxation approaches are quite fuzzy in differentiating their procedures from each other.

Comparison of both electroencephalographic and fMRI studies^{13–15} reveals that those techniques so compared, insight meditation, Vipassana or mindfulness meditation, Tibetan Buddhist “unconditional loving-kindness and compassion,” and Transcendental Meditation (TM), show characteristic and reproducible findings that are readily distinguishable from one another. As one of the authors notes, “Brain patterns are a language that cuts across differences in cultures, worldviews, and emotionally vested terms that can cloud consideration of different meditation practices”.¹³

This review demonstrates that different techniques from different traditions differ in procedure, have different effects

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in brain and body, and have quite distinguishable clinical and psychological outcomes. These outcomes suggest some to be more suitable for enhancing soldier resilience than others.

METHODS

This analysis used the following steps:

- (1) Identifies assumptions and screening criteria regarding training modalities for soldier resilience.
- (2) Through MEDLINE searches and informally through contacts in the Army, identifies significant candidates for training modalities (Table I).
- (3) Eliminates candidates who do not meet screening criteria.
- (4) Searches MEDLINE via PubMed to determine the volume of research done on the candidates (Table II).
- (5) Eliminates those candidates without an adequate base of data to support them.
- (6) Via searching MEDLINE as well as visiting Web sites for techniques known to be under consideration, composes a list of outcome parameters relevant to soldier

- resilience that have been used (and published) to study the top candidates.
- (7) Synopsizes the studies; reviews or meta-analyses that directly compare any of the selected modalities to one another are discussed, other studies listed in Table III.
 - (8) Discusses the findings and constructs an order of merit list for the modalities that survived scrutiny.
 - (9) Makes recommendations based upon the findings.

RESULTS

First Round Cuts as a Result of Feasibility Issues

Three of the modalities listed in Table I do not meet the “austerity” criteria listed in the introduction and thus do not make the first cut: pranayama includes breathing exercises that would be too conspicuous on an airplane or in an open bay; hatha yoga requires loose fitting clothing and a flat comfortable surface (no go while wearing body armor, or in a vehicle, or living and sleeping in the dirt); and reiki requires the therapeutic touch of a reiki practitioner.

TABLE I. List of Training Approaches Initially Considered (Alphabetical)

1	Battlemind
2	Biofeedback
3	Biofeedback (EMG)
4	Boot Strap /STARS/Stress Gym Interventions
5	Compassion Training
6	Concentration
7	Corporate Meditation (Thornton)
8	Kripalu Meditation
9	Mantra Meditation (Other Than TM)
10	Meditation (Any Other, Not Otherwise Specified)
11	Mindfulness Based Mind Fitness Training (by Jha)
12	Mindfulness Based Stress Reduction (by Kabat-Zinn)
13	Mindfulness Meditation (AKA Vipassana or Insight)
14	One Shot-One Kill
15	Penn Resiliency Program
16	Pranayama
17	PMR
18	Qi Gong
19	RR (Benson)
20	RR Meditation
21	Relaxation (other)
22	Reiki
23	Samurai Mind Training
24	Soft Belly Meditation
25	Super Calm Meditation
26	Tibetan Buddhist Meditation
27	Total Awareness
28	Transactional Analysis
29	TM
30	Warrior Mindfulness
31	Yoga, Hatha
32	Yoga Medics
33	Zen Meditation

TABLE II. Volume of Research

	Training/Modality	Number of Studies Found in PubMed
1	Biofeedback	6,083
2	TM	1,721
3	PMR	761
4	Transactional Analysis	481
5	Mindfulness Meditation	363
6	Concentration Meditation	231
7	Mindfulness-based Stress Reduction (Kabat-Zinn)	173
8	Biofeedback (EMG)/Stress Related	1,396/145
9	RR Meditation	102
10	Qi Gong (Chi Gung ~ Pranayam and/or Mindfulness)	90
11	Zen Meditation	60
12	RR (Benson)	58
13	Mantra Meditation (Other Than TM)	10
14	Tibetan Buddhist Meditation	9
15	Total Awareness (Mindfulness or TM)	8
16	Compassion Training (Military, Other Than Nurse Training)	7
17	Penn Resiliency Program	6
18	Battlemind	3, Plus Those Not Yet Published
19	Boot Strap/STARS/Stress Gym Interventions	3
20	Mindfulness-based Mind Fitness Training (Jha)	2
21	Kripalu Meditation	1
22	One Shot-One Kill	1
23	Warrior Mindfulness	1
24	Corporate Meditation (Thornton)	0
25	Samurai Mind Training	0
26	Soft Belly Meditation	0
27	Super Calm	0
28	Yoga Medics	0

TABLE III. References for the 3 Modalities Relevant to CSF Domains

Domain	TM	Mindfulness	PMR
Physical			
Hypertension	64–69	—	—
CV Disease and Risk	70–76	—	—
Tobacco, Alcohol, and Substance Abuse	83–87	37,77–82	88
HPA Axis, Lipids, Hormones, and Aging	90–99	89	—
Stress Reactivity and Reaction Time	46,58,100–103	—	—
Pain	113,114	106–112	104,105
Emotional and Spiritual			
Intelligence, Cognition, and Academics	102,115–120	121–123	—
Creativity and Morals	62,124–132	—	—
Anxiety and Depression	151–154	38,133–148	149,150
Sleep, Attention deficit hyperactive disorder, and PTSD	157–159,161	155,160	156
Social and Family			
Marital and Family	162,163	—	—
Discipline and Legal	164–169	—	—
Leadership, Efficiency, Tolerance, Social and Workplace Integration	170–183	—	—

Second Round Cuts as a Result of Deficiencies in Evidence-based Outcome Data

Starting with the least researched, this analysis eliminates yoga medics, super calm meditation, soft belly meditation, samurai mind training, corporate meditation, warrior mindfulness, kripalu meditation (assuming that the previous three are separate from other mindfulness discussed below), compassion training, Tibetan Buddhist meditation, and mantra meditation other than TM. These approaches may have value, but it is beyond the scope of this article to discern what that value might be. If they are to be included in the training modules for soldier resilience, inclusion would have to be for reasons other than evidence-based outcome data.

Nonspecific relaxation and meditation cannot be distinguished from more specific modalities and thus are not considered separately.

The three categories of mindfulness above, as well as the categories of both concentration and Zen meditation,¹⁶ are fairly indistinguishable; searches for one or the others often identify the same articles, and the methodologies appear to overlap, with perhaps some proprietary differences opaque to this analysis. Qi Gong references variably describe both pranayama and mindfulness; “total awareness” articles refer to either TM or mindfulness. Qi Gong and total awareness are cut. Although there may be significant differences among mindfulness techniques, they are not yet fully elucidated; for purposes of this evaluation, all mindfulness, Zen, insight meditation, Vipassana, and concentration, whether done with eyes closed or executed during activ-

ity or both, are retained but rolled up into a single category: mindfulness.

The Army’s Battlemind Training (the precursor to RT) has been studied as employed after the combat stress event.^{17,18} The Penn Resiliency Program (PRP)^{19–22} and the One Shot-One Kill, Boot Strap, STARS, and Stress Gym^{23–29} interventions have not been compared to one another; information is insufficient for this review to distinguish among these programs nor to compare them meaningfully to the meditative techniques considered. This analysis assumes that online behavioral and coping skills RT such as that currently available through the Army Knowledge Online link of the CSF program and face-to-face training such as the PRP (or its cousins, progeny, or successors) are here to stay, but will not be further discussed in this article.

The proponents of relaxation response (RR), a technique derived from TM, contend that stress management and relaxation and meditation techniques are all essentially the same. As a result of that assumption, they often borrow data freely from other specific techniques and attribute the results to the RR.³⁰ This contention is confusing and is not supported by neuroimaging data,¹³ nor by meta-analyses or comparative studies.^{31–33} But since its proponents also claim it can be learned from a book and is thus simple and inexpensive, it is tempting to include RR in further discussion. Three considerations militate against inclusion. First, its core assumption (of universal equivalence of techniques) appears unredeemable.^{13,31} Second, by its advocates’ own assertions, it is derivative: it brings nothing new or different to the fight. Third, available data demonstrate that it is inferior in its outcomes, whenever data exist to compare,^{31–33} to at least one other technique (TM) under consideration. For these reasons, RR is eliminated.

Biofeedback does not make the cut. Although it has thousands of citations, they mostly have to do with specific clinical entities such as incontinence or tinnitus, and the studies related to stress reveal very little applicable to resilience or the types of holistic fitness or continuous self-development objectives of CSF.

Transactional analysis does not make the cut; it has not been significantly studied. The culling above leaves three training modalities:

- mindfulness
- progressive muscle relaxation (PMR)
- TM

Descriptions of the Modalities and Differentiating Brain Effects

Mindfulness is traditional with some modern cognitive elements; its effects are mediated by changing the interpretation of internal and environmental cues and by enhancing coping skills. PMR is a modern laboratory-derived technique, which promotes muscular and subsequent mental relaxation. TM is a traditional technique, effecting changes in physical,

psychological, and social health and behavior through changes in brain (and related physiological) functioning.

Mindfulness

A variety of practices are fall under the rubric of “mindfulness,” which is commonly defined as a:

...dispassionate, non-evaluative and sustained moment-by-moment awareness of perceptible mental states. This includes continuous, immediate awareness of physical sensations, perceptions, affective states, thoughts, and imagery. Mindfulness is non-deliberative. It merely implies sustained paying attention to mental content without thinking about it, comparing or in other ways evaluating the ongoing mental phenomena that may arise during periods of practice.³⁴

Mindfulness meditation is described as a systematic procedure to develop enhanced awareness of moment-to-moment experiences. Mindfulness can include at least two meditation practices:

- with eyes closed: attention on breath
- with eyes open: dispassionate observation of body, senses, and environment. This meditation involves intention or directing of attention to physiological rhythms, inner thoughts, sensations, or outer objects.

Though derived from a Buddhist background, mindfulness is not a religion, does not require faith, and is compatible with any religious tradition.

Mindfulness is negatively correlated with resting activity in the amygdala bilaterally, as opposed to depressive symptomatology positively correlated with amygdalar activity.³⁵ During an “affect labeling” task of dispositional mindfulness, functional magnetic resonance imaging reveals widespread prefrontal cortical activation and reduced amygdalar activity.³⁶ A review of 7 “mainly poor quality studies” of Vipassana mindfulness included 3 with neuroimaging results, showing activation of prefrontal and anterior cingulate cortex.³⁷ Patients suffering from social anxiety disorder completing a course in mindfulness-based stress reduction (MBSR) showed reduced amygdalar activity and “increased activity in brain regions implicated in attentional deployment”³⁸ during one of two mindfulness tasks; healthy subjects had increased regional gray matter density after the MBSR course.³⁹ A review of Zen meditation showed an increase in alpha and theta waves frontally.¹⁶

Per a mindfulness instructor contacted by this author, a course in mindfulness was to include six sessions, a full day retreat and then a final session, with ~15 hours of contact time. As of 2008, the cost was \$100 an hour per person or \$1,500 for each individual. This course and fee structure may or may not be typical. Per its website, MBSR in 2010 had fees from \$450 to \$600 depending upon income.

Mindfulness is taught by many psychologists, Masters of Social Work, and other individuals. Some programs (such as MBSR) are fairly standardized. There is no umbrella organi-

zation that determines or enforces a standard for all mindfulness practice or instruction.

Progressive Muscle Relaxation

Descriptions of PMR abound. That in Wikipedia⁴⁰ is typical:

... a technique of stress management developed by American physician Edmund Jacobson in the early 1920s.⁴¹ Jacobson argued that since muscular tension accompanies anxiety, one can reduce anxiety by learning how to relax the muscular tension....

PMR involves alternately tensing and relaxing the muscles.⁴² A person practicing it may start by sitting or lying down in a comfortable spot and taking some deep breaths, and then he or she will proceed to tense, then relax, groups of muscles in a prescribed sequence.... The effect of the tension-relaxation sequence is to cause deeper relaxation than would be achieved by simply attempting to relax.

In theory, one can practice PMR on one’s own after simply reading some instructions, with perhaps some guidance as to which muscles to involve in what order. PMR also is commonly taught by therapists from many disciplines, including physical and occupational therapists. Fees for such services are variable.

Transcendental Meditation

TM is an effortless purely mental technique, practiced for 15 to 20 minutes twice daily, seated with eyes closed, requiring no other changes in lifestyle. It comes from the Vedic tradition of India and was popularized over the last 50 plus years by the late Maharishi Mahesh Yogi. Like mindfulness, it is not religious in nature. It uses what proponents describe as the “natural tendency of the mind” to move toward greater enjoyment and charm, effecting “automatic self-transcending”⁴³; during the practice, the mind easily moves toward subtler levels of thought and can “transcend” thinking altogether, allowing the mind and body to experience “restful alertness,” a state of unique and salubrious mental and physiological functioning.

Physiologically, restful alertness is associated with a state of rest, as reflected in decreased metabolism, respiration rate, and blood flow to the limbs, decreased sympathetic activity,⁴⁴ and increased mental alertness, as reflected in higher frontal electroencephalogram (EEG) coherence.⁴⁵ This experience allows the body to remove effects of previous stressors and to be more resilient to current stressors.⁴⁶

Restful alertness is associated with both activation of attentional systems and deactivation of thalamic input circuits in a positron emission tomography study¹⁵ and higher frontal EEG coherence—a measure of functional connectivity.^{47,48} The experience and associated brain state of restful alertness during TM practice is reflected in long-term changes in brainwave patterns during tasks outside of meditation practice—broadband frontal coherence, normally seen during TM practice, is progressively seen during challenging tasks with regular TM practice,⁴⁷⁻⁴⁹ enhancing frontal executive functioning.⁵⁰ Multiple studies

have documented characteristic EEG findings in TM; within the practice, power and alpha coherence increases,^{48,50-53} coherence which increased within 2 weeks of practice.⁵⁴

TM is proprietary and standardized. All TM instruction is performed only by teachers certified to teach TM by the global TM organization. The course of instruction is always the same, involving five sessions in the first week followed by optional "checking" weekly for the first month and monthly for the first year. As of early 2011, the U.S. course fee is \$1,500 per person, with a discount to \$1,200 per person for groups (family rates, military rates as low as \$750, and low-income scholarships also exist). Follow-up ("checking") is included in the course fee, lifelong and worldwide, as frequently as may be desired by the TM meditator.

Head-to-Head Comparisons and Meta-analyses

Comparing PMR and TM

In the first of two prospective randomized controlled trials (RCTs) of hypertensive African-Americans, the TM group had significantly decreased blood pressure compared to the PMR group and to usual care in a 3-month study of 150 subjects.⁵⁵ These findings were replicated in the second RCT, a 1-year-long study of 127 subjects. The TM group decreased its use of anti-hypertensive medication; the PMR group increased its use.⁵⁶

Comparing PMR and Mindfulness

In this 1-month RCT, 83 distressed college students were randomized to mindfulness, "somatic relaxation," or a no-treatment control. Both the mindfulness and relaxation groups similarly decreased distress and increased positive mood. Mindfulness was more effective in decreasing distractive and ruminative thought behaviors than was PMR or control.⁵⁷

Comparing TM and PMR

Eighty-three African-American college students were randomized to TM, PMR, or "cognitive strategies." A year later, both the TM and PMR groups were significantly improved in mental health and anxiety; TM showed greater reduction in neuroticism compared to both PMR and cognitive strategies. The TM group showed increased EEG coherence compared to eyes closed, other groups did not. The TM group had faster habituation to stressful stimuli than did the PMR group.⁵⁸

Comparing TM and PMR

Older hypertensives randomized to TM, PMR, or usual care were followed for mortality for a mean of 7.6 years. The TM group had 23% less all-cause mortality, 30% less cardiovascular mortality, and 49% less cancer mortality than combined controls.⁵⁹

Comparing Mindfulness and TM (and RR)

Seventy-three elderly were randomized to TM, mindfulness, or RR. The TM group had significantly better cognitive function, mental health, blood pressure, and survival compared to the other groups.³² Eight- and fifteen-year follow-ups con-

firmed TM group superiority in both cardiovascular and all-cause mortality.⁶⁰

Meta-analysis of PMR and TM (and Biofeedback) in Hypertension
TM significantly outperformed PMR (and biofeedback) in reduction of blood pressure among hypertensives.⁶¹

Meta-analysis of TM, PMR, and Other Meditations in Trait Anxiety

In 146 studies, the effect size for TM was more than double that of the others, including placebo, PMR, and other meditations including mindfulness, (and non-TM mantra meditation, biofeedback, and RR).³³

Meta-analysis of TM, Relaxation, Other Meditation (Including but Not Specifying Mindfulness)

In 42 studies, the effect size for TM was 3 times that of relaxation and other meditation in increasing self-actualization.⁶²

Meta-analysis of TM, PMR, and Mindfulness (and Numerous Other Modalities)

In eight meta-analyses of 597 studies of over 20,000 subjects, TM significantly outperformed other modalities across a host of outcomes, including improved psychological outcomes and decreased use of cigarettes, drugs, and alcohol.³¹

A review and meta-analysis of 27 studies concluded that "meditation" was more effective than progressive relaxation, autogenic training, and applied relaxation in reducing anxiety.⁶³

Studies of the 3 Modalities CSF Parameters

The Army's CSF Program recognizes five domains of life that require fitness/wellness for the soldier to function optimally: physical, emotional, spiritual, social, and family. Table III cites the extant literature regarding the three selected techniques.^{37,38,47,58,62,64-183}

DISCUSSION

Discussion is along four axes: efficacy, acceptability, quality control, and cost.

Efficacy

Limitations to the determination of efficacy are at least three: there may be significant distinctions between resilience, as desired by the U.S. Army, and the parameters cited in this evaluation; mindfulness and more so PMR have not been studied at all in some CSF domains (Table III); and the studies cited were almost universally not performed on American soldiers.

Of the three modalities, mindfulness, PMR, and TM, available data support TM as the most efficacious in virtually all the outcomes studied to date.³¹ TM has the greater volume of supporting research (with the exception of a larger volume of studies on mindfulness and pain) and more high-quality studies (prospective randomized controlled design) than the other two approaches. Virtually all the meta-analyses and

comparative studies show greater effect sizes for TM in conditions from hypertension^{56,60,61} to anxiety³³ to mortality,^{32,60} in populations varied in age, ethnicity, and nationality.

Conflicting data inhibit conclusions regarding the relative efficacy of mindfulness versus PMR. PMR may reduce anxiety⁶³ and substance abuse⁸⁸; the physiological underpinning of the cognitive improvements is as yet undetermined.⁸⁸ Some reviewers conclude that mindfulness has efficacy in stress reduction^{140,141,184} and a variety of other health issues.¹³⁹ Others conclude that it does not have a reliable effect on depression or anxiety¹⁴⁵ and has equivocal findings for sleep disturbance¹⁵⁵ and that the paucity of research does not support a strong endorsement of this approach.¹⁸⁵

Acceptability

There are no data to indicate that any one of the modalities would be more or less acceptable to soldiers than the others.

PMR is lab-generated with no elements from a non-Western culture. It may be more attractive to soldiers with muscular tension issues or those not comfortable with any form of “meditation.” PMR appears to be simple and have a modest time requirement and gentle learning curve although one review of 29 studies with various psychophysiological outcomes indicated that its effects are greater with more sessions, individualized treatment, and greater treatment duration.¹⁸⁶ There is no evidence of poor acceptability.

TM is unabashedly traditional. Professional teachers describe its origins in the Vedic tradition of India when introducing prospective students. Personal instruction in TM is always done on a one-to-one basis, in private. Also, it is proprietary; students are asked to keep their instruction private. In addition, “dabbling” in TM is actively discouraged. Teachers ask prospective students to commit to make and take the time to be regular in their twice-daily practice of TM, asserting that greater efficiency and enjoyment more than make up for the time spent meditating. These points may constitute barriers to learning TM for some soldiers. In the challenging population of psychiatric inpatients, TM was “more readily accepted with longer compliance than training in progressive relaxation or EEG alpha rhythm enhancement.”¹⁸⁷

The term “unique” is often used when describing TM; this term is a red flag for many.^{188–190} TM proponents explain “unique” thusly: automatic self-transcending is an innate human capability, but there are more and less efficient ways to reach that state, and the technique to elicit it is acquired. TM advocates quote their data and say that, by virtue of its long, many millennia-old tradition, TM is “uniquely” efficient in bringing about that healthy style of functioning in mind and body.

Mindfulness may be somewhat between TM and PMR in the areas discussed above. It is traditional; not as overtly as TM, but more than PMR. Acceptability may be a function of local issues as mindfulness is not standardized; but at least one program demonstrated 88% of participants still meditating after 4 months.¹⁰⁸ In a 2009 study, mindfulness was acceptable

when added to behavioral interventions in a family-focused adolescent drug prevention program.¹⁹¹ Time requirements for mindfulness may be comparable to PMR and TM. Long-term follow-up requirements have not been specified.

Quality Control

Mindfulness and PMR are both taught by a variety of therapists and counselors or in theory could be self-taught. Reliance upon qualified personnel should be adequate.

TM is always taught by certified TM teachers. A program of mandatory ongoing recertification of instructors assures good quality control.

Cost

There are no published data demonstrating any significant risks associated with the practice of any of the three modalities. Indeed, a study by the Swedish National Health Board in 1975 found that hospitalization for psychiatric care was 150 to 200 times less common for TM practitioners than for the general population.¹⁹² However, it is inevitable that some unfortunate young soldier who is destined to experience his or her initial psychotic break will do so soon after having been trained in one of the modalities; some stakeholders may see a cause-effect relationship where one has not been shown to exist.

Costs for TM and for mindfulness may be comparable. The cost for PMR may be less depending on the nature of contracting for individuals to instruct PMR.

TM has demonstrated lower health care utilization and costs.^{193–198} This may make TM attractive to soldiers, families, and organizations responsible for providing their medical and mental health services as the costs to society from combat-related PTSD alone are in the billions of dollars per year.¹ Mindfulness and PMR may have as yet undemonstrated beneficial effects on health costs. The magnitude of those savings, if any, is unknown.

RECOMMENDATIONS

- (1) Include one or more of the three modalities in the menu of training options for the promotion of soldier resilience, in this order: TM, a form of mindfulness, and PMR.
- (2) After proper Institutional Review Board vetting, randomize soldiers in unit(s) about to deploy to be trained in either one of the three recommended modalities or in a “usual care” control group. During and after deployment, measure performance on the GAT, the incidence of PTSD, Uniform Code of Military Justice actions, administrative discharges, divorces, substance abuse, and other physical, psychological, and behavioral health endpoints.
- (3) Adopt or develop metrics adequate to measure anticipated high-level growth in the domains of CSF (physical, emotional, spiritual, family, and social) as a result of this training; alternatively, the GAT could be

expanded and revalidated to accomplish this. Study a selected subpopulation with more in-depth physiological and psychological tests and neuroimaging.

- (4) Use the Soldier Fitness Tracker to identify the most effective of the training modalities.
- (5) Adopt the “best practice” identified by recommendations (2) and (4) and disseminate throughout the Army.

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