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Complementary/integrative healthcare utilization in US Gulf-War era veterans: Descriptive analyses based on deployment history, combat exposure, and Gulf War Illness

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Abstract

Complementary and integrative health (CIH) approaches have gained empirical support and are increasingly being utilized among U.S. military veterans to treat a myriad of conditions. A prominent condition affecting Gulf War era veterans is a cluster of medically unexplained chronic symptoms that can include fatigue, headaches, joint pain, indigestion, insomnia, dizziness, respiratory disorders, and memory problems. These symptoms are often referred to as Gulf War Illness (GWI). Gulf War era veterans experience a higher burden of these symptoms compared to veterans from other military conflicts, yet little is known about CIH use within this population, particularly among those with GWI. Using data collected as part of a larger study ($n = 1153$), we examined the influence of demographic characteristics, military experiences, and symptom severity on CIH utilization, and CIH utilization differences between Gulf War era veterans with and without GWI. Over half of the sample (58.5%) used at least one CIH modality in the past six months. Women veterans, veterans identifying as white, and veterans with higher levels of education were more likely to use CIH. The top five utilized CIH modalities were vitamins/minerals (42.8%), herbal vitamins and supplements (18.2%), massage (16.9%), chiropractic care

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(15.4%), and relaxation techniques (11.4%). Gulf War era veterans with a GWI diagnosis and higher GWI symptom severity were more likely to use at least one CIH treatment in the past six months. Over three quarters (82.7%) of veterans who endorsed using CIH to treat GWI symptoms reported that it was helpful for their symptoms. Almost three quarters (71.5%) of veterans indicated that they would use at least one CIH approach if it available at VA. Results provide a deeper understanding of the likelihood and characteristics of veterans utilizing CIH to treat health and GWI symptoms and may inform expansion of CIH modalities for Gulf War era veterans and particularly those with GWI.

Keywords

Veterans; Gulf War; Gulf War Illness; chronic multisymptom illness; Complementary and integrative health; Complementary and Alternative Medicine

1. Introduction

While generally considered to be “complementary and alternative” due to their nonmainstream status, treatment approaches such acupuncture, tai chi, yoga, and chiropractic care have gained traction in becoming evidence-based treatments (Schuman, 2016). The Veterans Health Administration (VHA) has been at the forefront of turning “complementary and alternative medicine” into “complementary and integrative health” (CIH) by increasing its utilization of such non-pharmacological treatment options for physical and mental health conditions common among U.S. military veterans (Taylor & Elwy, 2014). In 2011, 89% of Veterans Affairs (VA) medical facilities offered at least one of 31 practices considered to be complementary and alternative (Ezeji-Okoye, Kotar & Smeeding, 2013), and from 2017 to 2018, a national survey revealed that over half of VA sites offered at least five or more CIH approaches (Farmer et al., 2021). Additionally, acupuncture, therapeutic massage, biofeedback, hypnotherapy, tai chi, yoga, meditation, and chiropractic care have recently become a part of the VHA standard medical benefits package, further becoming incorporated into the health care system (Taylor, Hoggatt, & Klinger, 2019). Understanding patterns of engagement and utilization in CIH modalities will further inform expansion efforts in the VHA. Specifically, understanding CIH user profiles may assist clinicians in discussing evidence based CIH approaches for particular health conditions.

Uptake of CIH by veterans has been high, and interest in services are growing. In a national survey, over half of veterans reported that they used one of 26 CIH approaches in 2017 and 84% reported being interested in trying or learning about CIH treatments (Taylor, Hoggatt, & Klinger, 2019). Compared to veterans who did not utilize CIH, veterans who utilized CIH reported higher gastrointestinal symptoms, insomnia, asthma (Baldwin et al., 2002; White et al., 2011; Jacobson et al., 2009; Holliday et al., 2014), physical pain (Herman et al., 2019; Smith et al., 2007) and physical injury (Park et al., 2016), as well as higher anxiety and stress (Baldwin et al., 2002; McPherson & Schwenka, 2004; Goertz et al., 2013; Park et al., 2016). Gulf War era veterans (GWE; defined in this study as veterans who served

in 1990–1991 Gulf War era military operations) represent a subpopulation of veterans that report a higher burden of health conditions compared to other veterans (Dursa et al., 2016).

“Gulf War Illness” or “Chronic Multisymptom Illness” (Institute of Medicine, 2014; U.S. Department of Veterans Affairs, 2018) is the signature illness/injury of the GWE and describes a diverse set of medically unexplained symptoms characterized by persistent pain, fatigue, gastrointestinal problems, skin abnormalities, cognitive problems, and sleep disturbance (Research Advisory Committee on Gulf War Veterans’ Illnesses, 2014; Steele et al., 2012; The Iowa Persian Gulf Study Group, 1997). Interventions for the estimated 25 to 32% of GWE veterans who developed GWI are lacking (Holliday et al., 2014) and critically needed (Mawson & Croft, 2019). CIH modalities, such as acupuncture, meditation, yoga, and herbal supplements have shown promise for relieving a broad range of symptoms that GWI comprises (Nugent et al., 2021). Given emerging evidence on the benefits of CIH treatments for these symptoms, and the need to identify treatment options for GWI, it is important to understand psychosocial characteristics of those who utilize CIH services and whether they used CIH to treat GWI symptoms. To date, only one study has investigated CIH utilization in GWE veteran population (Holliday et al., 2014). Holliday and colleagues (2014) sought to examine how general stress, pain, insomnia, and depression symptom severity impacts CIH utilization (i.e., group and individual acupuncture, iRest Yoga Nidra meditation, and integrated health education classes) by comparing GWE vs. non-GWE veterans. Contrary to the literature, results revealed that GWE veterans did not endorse significantly higher symptom severity than non-GWE veterans. Participation in across CIH services, was generally consistent between the groups, although GWE Veterans attended significantly fewer sessions of group acupuncture.

The purpose of the present research was to expand on previous work on CIH and GWE veterans in several ways. First, this study combined guiding questions from Holliday (2014) and other studies (e.g., Park et al., 2016; Taylor et al., 2019) to examine the influence of demographic characteristics, military experiences, and GWI symptom severity on CIH utilization. Second, previous studies examined isolated symptoms of GWI (e.g., insomnia, stress, pain), rather than GWI as a constellation of symptoms or diagnosis. The current study followed evidence-based guidelines to establish criteria for GWI, as well as symptom severity. We also examined differences in CIH utilization between GWE veterans with and without GWI. Furthermore, we assessed whether veterans utilized CIH to specifically treat GWI symptoms.

2. Methods

2.1 Participants and Procedure

Data included in the present analyses were a part of the Gulf War Research and Individual Testimony (Project GRIT; $n = 1153$), which focused on the healthcare needs of GWE veterans (HSR& D VA Grant 1101HX001682). The Project GRIT survey, conducted January 2019 to August 2020, was administered to a national cohort ($N = 2724$) of deployed Gulf War era and non-deployed Gulf War era U.S. veterans. The overall survey response rate was 42.3 % ($1153/2724$). To be eligible, potential respondents had to have a history of military service during the Gulf War era in the VA administrative record, regardless of whether they

had deployed, resulting in an initial cohort of 1,098,991 Gulf War era veterans, including 133,461 women veterans (12.14 %). All study procedures, including consent and HIPAA authorization waivers, were approved by the Institutional Review Boards at the Durham VA Health Care System and the University of Utah. For additional information about the overall survey method, please see Blakey et al. 2021. Descriptive statistics for the sample are presented in Table 1.

2.2 Measures

2.2.1 Demographic Information—Veterans reported their age, gender, race, education, income, marital status, and VA-service connection status. To optimize comparison to previous studies on CIH among veterans, we dichotomized sociodemographic data in the same fashion as Park (2016) for analyses.

2.2.2 Mental and Medical Health Outcomes

2.2.2.1 General Health.: Participants were asked to evaluate their general health as *Poor* (1) to *Excellent* (5). We mirrored Park (2016) by dichotomizing this measure at 3, (good-excellent/poor-fair).

2.2.2.2 Posttraumatic stress disorder (PTSD).: PTSD was assessed using the Primary Care PTSD screen (PC-PTSD; Prins et al., 2015), a screening tool used to identify persons with probable PTSD.

2.2.2.3 GWI and Symptom Severity.: To increase specificity of cases, participants were considered to have a GWI diagnosis if they endorsed being diagnosed with GWI (yes/no) and they met criteria for GWI according to both of the two dominant classifications: the Centers for Disease Control criteria (Fukada et al., 1998) and the Kansas criteria (Steele et al., 2000). With respect to symptom severity, we utilized guidelines from Fukada and Colleagues (1998), wherein a case was defined based on endorsement of one or more chronic symptoms (present for 6 months) from at least two of the following categories: fatigue; mood and cognition; and musculoskeletal. If each case-defining symptom was rated as severe, we considered the overall case to have severe GWI; otherwise, if at least one of the symptoms was not severe, the case was considered to be mild to moderate.

2.2.3 Combat Exposure—We assessed combat exposure with the 7-item Critical Warzone Experiences Scale (CWE; Kimbrel et al., 2014). Using a 5-point Likert scale ranging from 0 (*Never*) to 4 (*10 or more times*), respondents rated the frequency to which they experienced a particular event during combat (e.g., “being directly responsible for the death of an enemy combatant”). The CWE Scale is a single factor structure, and has demonstrated good internal consistency, test-retest reliability, and convergent validity with other combat exposure scales (Kimbrel et al, 2014, 2015). For the purpose of our analyses, combat exposure was dichotomized (yes/no).

2.2.4 CIH Use—Participants rated both their utilization of CIH practices during the past six months and the number of times they used CIH in the past 12 months via items developed for the current study. Additionally, participants endorsed whether they used

CIH specifically to treat their GWI symptoms (yes/no), and how helpful they found each modality on a four-point Likert scale, ranging from not helpful at all to very helpful. The 13 specific modalities included in the survey were chiropractic care, acupuncture, massage, Tai Chi/Yoga/mind-body exercises, Pilates/movement, meditation/mindfulness, relaxation techniques, animal assisted therapy, biofeedback, homeopathy, special diets, vitamins/minerals, or herbal vitamins/supplements. Veterans were also asked if their VA offered any of the above modalities if they would consider utilizing them.

2.3 Data Analytic Plan

Analyses were conducted between March and August 2021 using SPSS Statistical Software Version 27 (IBM Corp, 2020). Descriptive statistics were computed to characterize the sample's sociodemographic background and relevant health histories. We then conducted chi-square tests of independence to examine bivariate associations between GWI diagnosis and CIH utilization. List-wise deletion was utilized for multivariate analyses, resulting in a total sample of $n = 516$. Continuous measures of participant age (Mdn age = 58-years-old), income ($Mdn = \$75,000$) were dichotomized via median-split in for multivariate analyses. Next, we conducted a series of logistic regression models to examine the influence of sociodemographic, military history, and health variables on CIH utilization.

3. Results

Table 2 displays participants' endorsement of past-six-month use of each CIH modality. Of the total sample, 58.5% used at least one of the 13 CIH modalities in the past six months. The top five utilized CIH modalities were vitamins/minerals, herbal vitamins and supplements, massage, chiropractic care, and relaxation techniques. Among veterans who did not utilize a CIH approach in the past six months, 71.5% endorsed they would utilize at least one CIH approach if the VA offered it. When considering each specific CIH approach, nearly one third (31% or more across CIH modalities) reported they would use chiropractic care, massage, or vitamins/minerals. Utilization of CIH to treat GWI symptoms specifically varied by CIH modality. Over half of veterans who used chiropractic care, acupuncture, massage, meditation and mindfulness, relaxation techniques, and herbal vitamins/supplements did so to treat GWI symptoms. Table 3 presents the percent of participants diagnosed with GWI who utilized each CIH modality specifically for the treatment of GWI. Across modalities, of those veterans that used CIH approaches to treat the GWI symptoms, 82.7% rated treatment to be helpful for addressing their symptoms.

3.1 Bivariate Analyses

Chi-square tests of independence examining CIH use by GWI diagnosis are summarized in Table 4. Significantly more veterans with a diagnosis of GWI used chiropractic services, acupuncture, massage, meditation/mindfulness, animal assisted therapy, biofeedback, and a special diet in the previous six months compared to veterans without a diagnosis of GWI. There were no differences by GWI diagnosis, however, when CIH approaches were defined broadly (i.e., any CIH utilization). Within specific modalities, there were no detected differences in utilization of Tai Chi, Yoga, mind-body exercises, Pilates/movement practices,

relaxation techniques, homeopathy or use of general or herbal vitamins and minerals between veterans with a diagnosis of GWI versus those without a diagnosis.

3.2 Multivariate analyses

Logistic regression models identifying participant characteristics associated with any and specific CIH modality use and are summarized in Table 5. Across modalities (i.e., any CIH), race emerged as the only significant predictor of any CIH use, with non-white Veterans being less likely to use CIH (OR = 0.61 CI = 0.41–0.91, $p < 0.05$). Logistic regression models were then run within each modality. Among sociodemographic variables examined, and in general, gender, race, and education were the most strongly associated predictors of CIH use. Specifically, relative to men, women were more likely to engage in Tai Chi, Yoga, mind-body exercises (OR = 4.43 CI = 2.33–8.41, $p < 0.001$), use massage (OR = 2.59 CI = 1.50–4.47, $p < 0.001$), use mindfulness or meditation (OR = 2.34, CI = 1.25–4.38, $p < 0.01$), and engage in relaxation techniques (OR = 2.24, CI = 1.24–4.04, $p < 0.01$). With respect to race, non-white veterans were less likely to engage in CIH, particularly, acupuncture, and Tai Chi, Yoga, and mind-body exercises (OR = 0.46, CI = 0.23–0.91, $p < 0.05$; OR = 0.46, CI = 0.23–0.91, $p < 0.05$). Veterans with a bachelor's degree or higher were more likely than veterans without at least a bachelor's degree to use relaxation techniques (OR = 2.64, CI 1.52–4.60, $p < 0.001$), mindfulness or mediation (OR = 1.98, CI = 1.10–3.57, $p > 0.05$), and Tai Chi, Yoga, or other mind-body exercises (OR = 2.22, CI = 1.18–4.16, $p < 0.01$). GWI symptom severity was the most robust health predictor of CIH use (see Table 6). Specifically, veterans who were considered to have severe cases of GWI were approximately four and a half times more likely to utilize animal-assisted therapy services (OR = 4.55, CI = 1.32–15.66, $p < 0.05$) and almost two and a half times more likely to use massage (OR = 2.44, CI = 1.19–5.02, $p < 0.05$) relative to veterans with mild-to-moderate cases of GWI. In terms of military history, those who were deployed to the Persian Gulf region during the Gulf War era were less likely to use CIH modalities (see Table 7). The overall models for chiropractic services, Pilates/movement, biofeedback, special diet, and herbal vitamins/supplements were non-significant.

4. Discussion

Results from this study highlight CIH utilization among Gulf War era veterans and differences in CIH utilization among Gulf War era veterans with and without GWI. Similar to previous studies, we found that factors associated with CIH use varied by CIH modality (Taylor, Hoggatt, & Kliger, 2019; Park et al., 2016). Such findings suggest that CIH practices should be considered individually to best understand patterns of utilization among Gulf War era veterans. One factor that may contribute to higher utilization of certain modalities, such as massage, is the extent to which the modality is integral in more mainstream healthcare approaches (Taylor, Hoggatt, & Kliger, 2019; Park et al., 2016). Integration into mainstream healthcare approaches may increase veteran exposure to knowledge about the modality as well as increase clinician referrals. This may help explain why vitamins/minerals and herbal vitamins and supplements were among the most used modalities. Further specificity of individual practices in future studies may clarify patterns of

CIH use among veterans, given the breadth of potential practices within each modality (e.g., relaxation techniques).

With respect to demographic factors, we found that women veterans, veterans identifying as white, and veterans with higher levels of education were more likely to use CIH approaches. These findings are consistent with other literature on CIH use among veterans (Taylor, Hoggatt, & Kliger, 2019; Park et al, 2016). Previous research hypothesizes that women may be more likely than men to use CIH because they take a more proactive approach to medical care as a result of gender stereotypes, socioeconomic status, or personal health beliefs (Kristoffersen et al., 2014). Higher education and CIH use may relate to increased awareness of treatment options and skills to seek out CIH resources (Bishop & Lewith, 2010). With respect to race, non-white populations in the United States have historically had decreased access to traditional medical care and such lack of access may have translated to relatively greater access to CIH treatments. At the same time, increased barriers to care and insufficient health coverage may also be factors that attenuate utilization of non-traditional treatment modalities (Keith et al., 2007). Other studies have also found inconsistencies in race predicting CIH use (Park et al., 2016; Bishop & Lewith, 2010). Future research may find it useful to characterize participants beyond demographic information such as race to examine ways in which culture shapes exposure, knowledge, and acceptability of different types of CIH modalities. Previous research suggests that cultural elements, such as spirituality, play a role in veteran interest in CIH approaches (Schuman, 2016). For participants to utilize any intervention they must find it to be acceptable. Acceptability can be influenced by values and perceptions related to ethnicity, culture, education, and personal experience (Middleton et al., 2013). Research on CIH approaches such as yoga suggest that sociocultural elements such as age, race/ethnicity, and socioeconomic status may “shape perceptions of yoga which could directly impact an individual’s decision to participate in yoga” (Spadola et al., 2020, p. 21). Discourses of CIH practices may result in people thinking that CIH approaches are inaccessible and/or may not be beneficial to them (e.g., yoga as feminized and commercialized into a Western fitness practice). Future frameworks for such investigations might include the Theory of Planned Behavior (TPB), which describes how attitudes, subjective norms, and self-efficacy shape behavioral intention and predict behavioral engagement (Ajzen, 1991). For example, if veterans have negative attitudes about CIH modalities or help seeking in general, they may be less likely to utilize these modalities until their symptoms become more severe. These attitudes might also be influenced by discourses around particular CIH modalities, and how others close to them (e.g., other veterans, or people of similar sociodemographic backgrounds) may perceive their engagement (i.e., subjective norms). Previous studies using TPB have provided support for such hypotheses. For example, attitude and beliefs about psychological problems are predictive of treatment seeking among veterans (Britt et al., 2011). Qualitative studies have also documented military member concerns about negative consequences to their military career reduces the likelihood that they will seek mental health care (Stecker et al., 2007). Additionally, TPB may be helpful in VHA strategies for dissemination of CIH within VA. A recent study demonstrated that self-efficacy regarding preparedness to discuss non-pharmaceutical approaches to care significantly impacted VHA provider integration of Whole Health strategies into their clinical practice (Shamblen et al., 2018).

The current study is the first to explicitly examine the relation of GWI diagnosis and severity to Gulf War era veteran CIH utilization. Gulf War era veterans with a GWI diagnosis were more likely than veterans without a GWI diagnosis to use over half of the CIH treatments in the past six months. Not all veterans with GWI, however, utilized CIH to specifically treat GWI symptoms. Most veterans who endorsed using CIH to treat GWI symptoms reported that it was helpful for their symptoms. Given the broad range of symptoms encompassed in GWI and breadth of CIH modalities, qualitative interviews may assist in elucidating which CIH treatments veterans choose to treat specific GWI symptoms. Our study showed that veterans who reported severe symptoms of GWI were more likely to engage in various CIH modalities, particularly animal-assisted therapy services and massages. It is well documented that veterans are more likely to choose CIH modalities when they are dissatisfied with conventional medicine practices or feel that their symptoms are not being addressed (Schuman, 2016). Due to the gaps in knowledge regarding etiology, prognosis, and treatment of GWI, Gulf War veterans may feel particularly invalidated and frustrated (Kaimal & Dietrich-Hartwell, 2020). Interventions for GWI are limited and may therefore be particularly appealing to veterans who have tried other treatments for their GWI symptoms without satisfactory results. Given the cultural shift in the VHA toward increased acceptance of CIH by clinicians, in combination with emerging hypotheses regarding the etiology of GWI, future referrals for CIH practices may increase. Future studies are needed, however, to demonstrate the efficacy and effectiveness of CIH practices to guide the referral process and uptake of CIH.

4.1 Limitations

While this study provides important implications for the utilization of CIH treatments among veterans with GWI, these findings must be considered in the context of the study's limitations. First, all participants in the study had received care through the VA, thereby excluding any veterans who may be receiving care outside the VA or are not associated with the VA. Historically, differences have been found between veterans who seek healthcare at the VA compared to those who obtain non-VA healthcare (Weeks et al., 2008). In efforts to limit survey length, we did not investigate which modalities were currently offered across the multisite study, which may have also played a role in utilization patterns. This survey asked about the treatment of GWI *symptoms* using CIH rather than treatment of GWI *diagnosis*. Therefore, we cannot be certain that veterans used CIH to treat the constellation of GWI symptoms as the whole and as a diagnosis rather than using CIH to treat single GWI symptoms present in diagnostic criteria for non-GWI mental health and physical health conditions. Furthermore, this study utilized cross-sectional design, relied on self-report measures from veterans and their perception of other attempted treatments for their GWI.

4.2 Conclusion

This study provides information regarding the clinical and demographic characteristics of veterans utilizing CIH to treat GWI symptoms. Results may inform expansion of CIH modalities for Gulf War era veterans and particularly those with GWI. While not all CIH modalities have empirical support to treat all GWI-related clinical phenomena, understanding the pathophysiology of GWI and the relationship to known mechanisms of CIH may introduce more effective treatments for veterans suffering from GWI. As

treatments are developed, veteran acceptability of CIH interventions will play a key role in their uptake and may further explain utilization patterns.

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Table 1.

Characteristics of veteran sample (N = 1153)

Characteristic	Total sample (N = 1153)				Multivariate sample (n = 516)			
	Missing Data		Observed		Missing Data		Observed	
	n	%	n	%	n	%	n	%
Gender	17	(1.50)						
Male			890	(77.20)			394	(76.40)
Female			246	(1.30)			122	(23.60)
Race	39	(3.40)						
White			738	(64)			344	(66.70)
Non-white			376	(32.60)			172	(33.30)
Age								
Median of 58			503	(43.60)			229	(44.40)
Median of 58			533	(46.20)			287	(55.60)
Education	6	(0.50)						
BA			669	(58)			312	(60.50)
BA			478	(41.50)			204	(39.50)
Income	40	(3.50)						
\$75,000			617	(53.50)			287	(55.60)
\$75,000			496	(43.0)			229	(44.40)
VA Service Connected	51	(4.40)	898	(77.90)	13	(2.5)	426	(82.60)
Deployed	35	(2.20)	454	(39.40)			245	(47.50)
Endorsed any combat exposure	127	(11)	491	(42.60)			302	(58.50)
General health	24	(2.10)						
Poor-fair			390	(33.80)			202	(39.10)
Good-excellent			739	(64.10)			314	(60.90)
PTSD			314	(27.20)			226	(43.80)
GWJ			109	(21.12)	13	(2.5)	62	(12)
GWJ severity	4	(3.70)						
Mild-moderate			70	(64.20)			38	(61.30)
Severe			35	(32.1)			24	(38.70)

Table 2.

CIH use during past six months (N = 1153)

CIH modality	<i>n</i>	%
Any CIH	675	58.50%
Vitamins/minerals	494	42.80%
Herbal vitamins/supplements	210	18.20%
Massage	195	16.90%
Chiropractor	177	15.40%
Relaxation techniques	131	11.40%
Meditation/mindfulness	107	9.30%
Special diet	96	8.30%
Tai Chi, Yoga, mind-body exercises	96	8.30%
Acupuncture	61	5.30 %
Pilates/movement	35	3.00%
Animal assisted therapy	20	1.70%
Homeopathy	19	1.60%
Biofeedback	7	0.60%

Table 3.CIH used by veterans diagnosed with GWI ($n = 109$)

CIH modality	<i>n</i>	%
Chiropractor for any reason	31	28.40%
Chiropractor for GWI specifically	15	13.80%
Acupuncture for any reason	15	13.80%
Acupuncture for GWI specifically	13	11.90%
Massage for any reason	30	27.50%
Massage for GWI specifically	20	18.30%
Tai Chi, Yoga, mind-body exercises for any reason	13	11.90%
Tai Chi, Yoga, mind-body exercises for GWI specifically	7	6.40%
Pilates/movement for any reason	6	5.50%
Pilates/movement for GWI specifically	4	3.70%
Meditation/mindfulness for any reason	20	18.30%
Meditation/mindfulness for GWI specifically	17	15.60%
Relaxation techniques for any reason	16	14.70%
Relaxation techniques for GWI specifically	10	9.20%
Animal assisted therapy for any reason	10	9.20%
Animal assisted therapy for GWI specifically	6	5.50%
Biofeedback for any reason	4	3.70%
Biofeedback for GWI specifically	3	2.80%
Homeopathy for any reason	2	1.80%
Homeopathy for GWI specifically	1	0.90%
Special diet for any reason	19	17.40%
Special diet for GWI specifically	8	7.30%
Vitamins/minerals for any reason	53	51.40%
Vitamins/minerals for GWI specifically	26	23.90%
Herbal vitamins/supplements any reason	25	22.90%
Herbal vitamins/supplements for GWI	15	13.80%
Any CIH any reason	72	66.10%
Any CIH GWI specifically	48	44%

Table 4.

Summary of bivariate (chi-square) tests of associations between GWI diagnosis and CIH utilization

CIH modality	GWI Diagnosis (n = 109)		No Diagnosis (n = 1022)		χ^2	p	Φ
	n	%	n	%			
Any CIH	72	6.40%	594	52.50%	2.56	0.11	0.11
Vitamins/minerals	53	4.70%	435	38.50%	1.48	0.23	0.04
Chiropractor	31	2.70%	143	12.60%	15.80	<0.001	0.12
Massage	30	2.70%	162	14.30%	9.52	0.002	0.09
Herbal vitamins/supplements	25	2.30%	181	7.40%	1.81	0.18	0.04
Meditation/mindfulness	20	1.80%	84	7.40%	12.10	<0.001	0.10
Special diet	19	1.70%	77	6.80%	12.42	<0.001	0.12
Relaxation techniques	16	1.40%	112	9.90%	1.36	0.24	0.04
Acupuncture	15	1.30%	46	4.10%	16.55	<0.001	0.12
Tai Chi, Yoga, mind-body exercises	13	1.10%	82	7.30%	1.95	0.16	0.04
Animal assisted therapy	10	0.90%	10	0.90%	38.09	<0.001	0.18
Pilates/movement	6	0.50%	28	2.50%	2.58	0.12	0.05
Biofeedback	4	0.40%	3	0.30%	18.25	<0.001	0.13
Homeopathy	2	0.20%	16	1.40%	0.05	0.83	0.01

Table 5.

Sociodemographic characteristics associated with use of CIH (n = 516)

CIH Modality	Gender ^a		Race ^b		Age ^c		Education ^d		Income ^e	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Chiropractor [^]	1.42	0.81–2.49	0.58	0.35–1.00	0.70	0.43–1.12	1.00	0.61–1.63	1.27	0.79–2.07
Acupuncture	2.12	0.90–4.96	0.28 ^{***}	0.10–0.75	0.96	0.45–2.06	1.89	0.85–4.19	0.95	0.43–2.09
Massage	2.59 ^{***}	1.50–4.47	1.06	0.64–1.77	0.46 [*]	0.28–0.75	1.59	0.97–2.59	2.31 ^{***}	1.41–3.79
Tai Chi, Yoga, mind-body exercises	4.43 ^{***}	2.33–8.41	0.46 [*]	0.23–0.91	0.64	0.34–1.19	2.22 ^{**}	1.18–4.16	0.78	0.41–1.46
Pilates/movement [^]	2.79	1.02–7.64	1.02	0.39–2.66	1.34	0.54–3.32	1.10	0.42–2.83	1.12	0.43–2.90
Meditation/mindfulness	2.34 ^{**}	1.25–4.38	0.81	0.44–1.48	0.67	0.37–1.20	1.98 [*]	1.10–3.57	0.50 [*]	0.27–0.93
Relaxation techniques	2.24 ^{**}	1.24–4.04	1.07	0.62–1.87	1.14	0.62–1.87	2.64 ^{***}	1.52–4.60	0.61	0.34–1.08
Animal assisted therapy	2.38	0.68–8.37	0.58	0.18–1.89	0.54	0.16–1.81	1.81	0.57–6.29	0.59	0.17–2.05
Biofeedback [^]	0.41	0.03–6.74	5.16	0.50–53.39	0.84	0.13–5.55	2.98	0.45–19.73	0.42	0.04–4.30
Homeopathy	7.85 ^{***}	2.15–28.62	0.81	0.24–2.73	0.68	0.21–2.22	1.77	0.54–5.80	0.52	0.14–1.86
Special diet [^]	1.59	0.74–3.44	0.85	0.42–1.73	0.55	0.28–1.11	0.11	0.56–2.21	0.95	0.48–1.87
Vitamins/minerals	1.91 ^{**}	1.22–3.00	0.61 [*]	0.41–0.91	1.06	0.74–1.53	1.14	0.78–1.67	0.83	0.57–1.21
Herbal vitamins/supplements [^]	1.81 [*]	1.07–3.06	0.86	0.52–1.41	1.23	0.78–1.95	1.02	0.64–1.64	1.30	0.81–2.08
Any CIH	2.15	1.31–3.51	0.61 [*]	0.41–0.91	0.76	0.52–1.11	1.30	0.87–1.93	0.99	0.67–1.45

* $p < 0.05$

** $p < 0.01$

*** $p < 0.001$

[^] non-significant model

^a Reference group is female

^b Reference group is non-white

^c Reference group is median age of 58

^d Reference group is bachelor's degree

Reference group is median income of 75k

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Table 6.

Physical and mental health symptoms associated with CIH use (n = 516)

CIH Modality	GWI Severity ^a		PTSD ^b		Self-Rated Health ^c	
	OR	95% CI	OR	95% CI	OR	95% CI
Chiropractor [^]	1.00	0.47–2.12	1.06	0.62–1.84	0.68	0.41–1.14
Acupuncture	6.80 ^{***}	2.30–20.10	1.33	0.54–3.26	2.07	0.83–5.21
Massage	2.44 [*]	1.19–5.02	0.78	0.44–1.37	0.76	0.44–1.31
Tai Chi, Yoga, mind body exercises	1.31	0.51–3.35	1.39	0.70–2.76	0.89	0.46–1.73
Pilates/movement [^]	3.58	1.08–11.90	1.23	0.41–3.73	1.48	0.52–4.22
Meditation/mindfulness	1.97	0.87–4.47	1.10	0.56–2.15	0.83	0.44–1.57
Relaxation techniques	1.82	0.84–3.94	1.55	0.84–2.88	0.89	0.49–1.60
Animal assisted therapy	4.55 [*]	1.32–15.66	3.62	0.68–19.29	0.83	0.24–2.87
Biofeedback [^]	13.40	1.04–172.33	0.51	0.04–6.64	1.19	0.21–11.82
Homeopathy	2.67	0.52–13.72	0.61	0.15–2.48	0.64	0.19–2.16
Special diet [^]	1.28	0.46–3.56	0.70	0.32–1.51	0.81	0.39–1.68
Vitamins/minerals	1.67	0.91–3.06	0.81	0.52–1.24	1.12	0.75–1.70
Herbal vitamins/supplements [^]	1.49	0.69–3.20	0.77	0.45–1.34	1.30	0.77–2.19
Any CIH	1.53	0.84–2.89	0.95	0.61–1.49	1.13	0.74–1.71

* $p < 0.05$

** $p < 0.01$

*** $p < 0.001$

[^] non-significant model

^a Reference group is severe GWI

^b Reference group is positive PTSD diagnosis

^c Reference group is poor health

Table 7.

Military History associated with CIH use (n = 516)

CIH Modality	Deployment ^a		Combat Exposure ^b	
	OR	95% CI	OR	95% CI
Chiropractor [^]	1.08	0.65–1.79	1.06	0.64–1.75
Acupuncture	0.41 [*]	0.18–0.94	4.06 ^{**}	1.52–10.80
Massage	0.75	0.45–1.25	1.58	0.90–2.76
Tai Chi, Yoga, mind body exercises	0.51 [*]	0.26–1.00	1.81	0.90–3.68
Pilates/movement [^]	0.61	0.22–1.69	2.20	0.72–6.75
Meditation/mindfulness	0.61	0.32–1.16	1.14	0.59–2.22
Relaxation techniques	0.54 [*]	0.30–0.97	1.22	0.66–2.27
Animal assisted therapy	0.63	0.19–2.06	4.97	0.79–29.42
Biofeedback [^]	0.52	0.06–4.69	0.93	0.07–11.78
Homeopathy	0.41	0.09–1.74	1.80	0.50–6.48
Special diet [^]	0.90	0.45–1.82	2.23 [*]	1.00–4.96
Vitamins/minerals	0.93	0.67–1.45	1.04	0.68–1.57
Herbal vitamins/supplements [^]	0.79	0.48–1.29	1.30	0.77–2.18
Any CIH	0.82	0.55–1.23	1.36	0.87–2.05

*
 $p < 0.05$ **
 $p < 0.01$ ***
 $p < 0.001$ [^]
non-significant model^a
Reference group is endorsed deployment^b
Reference group is experienced combat exposure