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<http://hdl.handle.net/10945/42275>



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Estimating the Costs of Care

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Traumatic brain injury (TBI) is an important public health concern in the United States, particularly as service members return home from the combat operations in Afghanistan, Iraq, and other locations in service of Operations Enduring Freedom and Iraqi Freedom (OEF/OIF) and Operation New Dawn (OND). According to the U.S. House Committee on Veterans' Affairs, more than 2 million service members have served at least one tour of duty in service of OEF/OIF and hundreds of thousands have served more than one tour (U.S. House Committee on Veterans' Affairs, March 18, 2010). Longer deployments and more redeployments place considerable strain on health care systems in terms of care for military personnel with mild TBI (mTBI), as well as posttraumatic stress disorder (PTSD).

Indeed, PTSD is a substantial problem among OEF/OIF veterans in its own right and it commonly co-occurs with TBI (Carlson et al., 2010; Hoge & Castro, 2006; Hoge et al., 2008). For example, between 64 and 67% of OEF/OIF Veterans Health Administration (VHA) patients with confirmed TBI also have a diagnosis of PTSD (Carlson et al., 2010; Iverson, Hendricks, Kimerling, Krengel, Meterko, Stolzman, et al., 2011). Non-treatment-seeking samples likewise have shown high rates of the comorbidity, with just over one-third of those screening positive for TBI also screening positive for PTSD (Tanielian & Jaycox, 2008). Although the occurrence of both TBI and PTSD is receiving unprecedented attention in the clinical literature, little is known about the economic toll resulting from these problems and their treatment costs in the long run. To shape health care policy

to meet the clinical needs of individuals with TBI and/or PTSD, clinicians and researchers can draw on economic information to inform their work.

For the nonveteran population, more emphasis is now placed on the lasting effects and costs associated with civilian head injuries, including sports concussion. For example, the Centers for Disease Control and Prevention, National Center for Injury Prevention and Control has created guidelines and produced "toolkits" for infants, youth sports, the elderly, and physicians' private practices (Centers for Disease Control and Prevention, 2011). As with military TBI, psychiatric disorders often emerge with civilian mTBI. A recent prospective study of Australian civilians with mTBI indicated that during the 12 months following the injury, over 7% had developed new onset PTSD, 6% had developed generalized anxiety disorder, 7% had developed agoraphobia, and 7% had developed depression (Bryant et al., 2010). A comprehensive overview of the costs associated with TBI resulting from civilian injuries (e.g., motor vehicle accidents, interpersonal violence, falls, sports-related concussions) is beyond the scope of this review despite the increased importance of the large costs related to emergency response teams, emergency room visits, lengthy hospital stays, exploratory medical testing, and follow-up care. Therefore, this chapter centers on the costs of treating mTBI and PTSD in military veterans, but connections are drawn to civilian injuries where possible.

For clinicians, understanding health care costs is important for comprehending how to best address patient needs. This review does not provide extensive treatment implications, but it is noteworthy that, as with other conditions, the length of treatment may increase (and costs rise) as a direct result of insufficient initial diagnosis and care (Baldessarini, 1989; Hall, 1994; Wells et al., 1989). If patients are not provided with appropriate treatment avenues, they may become disillusioned with the medical community and as such require longer treatment or further support from family members. In addition, without proper assessment and treatment, exacerbations in physical and mental health symptoms may occur (McCarthy et al., 2006). This chapter is intended to help the clinician gain knowledge of the direct and indirect costs relevant to initiatives designed to optimize treatment outcomes for patients with mTBI and/or PTSD.

In addition to direct clinical care costs, this chapter discusses the financial burden placed on OEF/OIF patients and civilians suffering from mTBI and PTSD, on caregivers, and on society at large. Given the average age (about 32 years) and earning potential of the relatively young veterans in this OEF/OIF cohort, and that very young children (ages 0–4) and adolescents are disproportionately represented among civilian TBIs (Faul, Xu, Wald, & Coronado, 2010), these indirect costs are especially important. Financial burdens include the length of time the individual will be absent from gainful employment, will require assistive services to remain in school

or at work, and will have an impact on the type and amount of treatment many individuals will choose to obtain. Financial considerations also affect clinicians' ability to provide treatment initiatives in traditional care facilities.

This chapter is not intended as a complete review of the literature on health care costs associated with PTSD and mTBI in the acute and chronic stages. Such reviews already exist (e.g., McGarry et al., 2002; Schootman, Buchman, & Lewis, 2003) and have pointed out the shortcomings in current understanding of the direct costs of care for mTBI and PTSD. Instead, our overview summarizes treatment information in four parts. Specifically, we provide (1) estimates of the incremental direct medical costs of treating both mTBI and PTSD rather than either condition alone; (2) estimates of costs associated with different models of care (i.e., outpatient vs. inpatient care); (3) long-term direct and indirect costs that may result from not treating the conditions effectively; and (4) clinical implications of the relative costs, including long-term costs and those borne by the patient compared to the health care system paying for the care.

We take a societal perspective on costs (Gold, Siegel, Russell, & Weinstein, 1996). If costs in one part of the system decline because services (and therefore costs) in another part of the system increase, the impact on the whole (whether a net increase or decrease) is taken into account. We base our direct medical cost estimates of treating one condition (mTBI only or PTSD only) versus two conditions (mTBI plus PTSD) on Department of Veterans Affairs (VA) benefits, which covers medical and psychiatric conditions related to military service at 100% (i.e., no patient payment) for up to 5 years following separation from the military (and longer if the conditions are disabling). Thus, our estimates of medical costs are not restricted to the limited perspective of a hospital, nursing home, or clinical practice.

A societal perspective also incorporates the impact on the individual and his or her family and friends. Some types of treatment place a greater burden and cost on these individuals than do other treatments. For example, outpatient visits tend to be much less costly to the medical system (e.g., the insurer or the system like the VHA that provides the care) than an equal number of inpatient days of care, but the former may require significantly more expense for travel to and from the outpatient clinics compared to an inpatient stay. Indirect costs of treatment, such as travel or lost workdays, which are borne directly by the patient (or perhaps his or her parents in the case of youth injuries), may affect whether the patient misses appointments, delays treatment, or requires additional appointments, all of which may increase waiting times for other individuals and result in lost work productivity for clinicians with high rates of "no shows." Attendance at care may also influence the extent to which patients can and do recover from these conditions.

Incremental Cost of Treating One versus Both Conditions

In this section, we first present VHA costs from our study of patients who were deployed at some time since 2002 to OEF/OIF and were screened within the VHA for mTBI during fiscal year (FY) 2008 or the first half of FY 2009 (October 1, 2007, through March, 2009; Hendricks et al. 2011). We then briefly list the types of direct costs incurred by patients and families, without attaching monetary values to these cost categories. Finally, we present a listing of some of the major components of evidence-based treatments such as psychotherapies, rehabilitation therapies, and medications for mTBI and PTSD, with estimates of minimal payments based on publicly available Medicare payment rates for the therapies and examinations plus prescription medication prices at Costco (a publicly available price list for a low-cost pharmacy retailer).

Annual Costs to VHA by Condition for FY 2008

Table 13.1 displays annual total costs to the VHA for patients with mTBI or PTSD (or both) and compares them with the costs for patients with neither condition. The mTBI designation comes from VHA's national TBI screening system. VHA administers a national four-part TBI screen as part of its electronic medical records system for clinical reminders to all veterans who report OEF/OIF deployment (Department of Veterans Affairs, 2009). Veterans who respond positively to one or more problem in each of the four sections of the TBI screen are considered to screen positive for TBI; the clinician is then instructed to discuss the results with the veteran and offer a referral for a comprehensive TBI evaluation. The determination of a TBI diagnosis is made by the clinical evaluator who uses a defined protocol, as part of a comprehensive TBI evaluation, to collect information about the origin of the injury, assess symptoms, confirm or rule out mTBI, and list possible follow-up care in a treatment plan. The PTSD diagnosis for Table 13.1 is from VHA utilization data for face-to-face visits with clinicians who listed the diagnosis as a reason for the visit. For patients with only the PTSD diagnosis, we distinguish between those who initially screened negative for mTBI and those who screened positive but had TBI ruled out in the comprehensive TBI evaluation. Patients in all of these categories can and often do have other diagnoses, both medical and psychiatric. Thus, it is important to recognize that costs of patients with positive screens who had TBI ruled out likely reflect other comorbidities being evaluated or treated.

Table 13.1 also presents mean costs for VHA inpatient and outpatient care (excluding outpatient medications). For the inpatient costs, we calculated the means for care provided in the medical/surgical wards or

bed sections of the VHA and contrasted them with the means for care provided in psychiatric and long-term care wards (nonmedical/surgical care). These distinctions underscore important cost differences for these patient groups.

First, the variation in annual costs within each cell depicted within Table 13.1 is large, especially for inpatient costs (as indicated by standard deviations that are many times the mean values). Given the variation, the differences in acute medical/surgical inpatient care across diagnostic groups are not statistically significant except for patients with mTBI only, who had medical/surgical costs significantly lower than those for any other patient group in this table. However, nonmedical/surgical inpatient costs (reflecting psychiatric, rehabilitation, and long-term care stays) are significantly different across the diagnostic groups.

Second, the average costs of three of the care categories (i.e., nonmedical/surgical inpatient, outpatient, and total costs) increase across the rows of Table 13.1 from patients with neither diagnosis (lowest costs) to those with mTBI only, PTSD only, and both mTBI and PTSD diagnoses (highest costs). Further, these differences are all statistically significant except for that in nonmedical/surgical inpatient care for patients with TBI only compared to PTSD only (column B vs. C). This direct relationship between inpatient costs for psychiatric or long-term care bed sections across the diagnosis groups reflects that patients with both conditions tend to receive more care in VHA and therefore incur higher costs.

Third, the incremental annual cost of having both diagnoses compared to only one is roughly \$4,000 to \$5,000 (\$9,957-\$6,053 = \$3,904; \$9,957-\$4,846 = \$5,111). This difference is significantly greater than the difference between the costs for either diagnosis alone compared to patients with neither diagnosis (\$2,472). This may be due, in part, to increased costs associated with other common comorbidities, especially psychiatric conditions (e.g., depression), which are common among patients with both mTBI and PTSD (see Iverson, Chapter 3, this volume). In addition, these average VHA costs are for the first year in which these war-zone veterans were routinely screened for mTBI in VHA; therefore, the higher costs may reflect additional evaluations and consults to determine the causes of other symptoms uncovered during the mTBI screening process and to provide treatment for them. The expectation is that in general these cost differences would diminish over time as conditions are effectively treated and thus alleviated.

The higher outpatient costs for patients with PTSD may be due to various factors. One such factor may be poorer physical health among veterans with PTSD as there is now strong evidence linking PTSD to poor health, including increased rates of health conditions that may become chronic (Schnurr, Green, & Kaltman, 2007), even among OEF/OIF veterans, whose trauma exposure was relatively recent (Seal, Bertenthal, Miner, Sen, & Marmar, 2007). Another factor may relate to differences in the clinical guidelines for the treatment of PTSD relative to mTBI. VHA clinical guidelines indicate that PTSD patients can be referred for psychotherapy and medications (e.g., Institute of Medicine, 2008), whereas the treatment guidelines are not as clear for the treatment of mTBI. For example, prolonged exposure (PE) and cognitive processing therapy (CPT) are recommended as the first-line treatments for PTSD (Veterans Health Administration, 2003), with nationwide clinician training efforts underway making these treatments available to all veterans with PTSD being treated in VHA. These clear treatment guidelines may lead to an increase in the availability and utilization of the treatments for patients with mTBI and PTSD, which lead to higher costs in the short term. However, as stated previously, as

TABLE 13.1. Mean (SD) Annual Costs per Patient in Dollars of VHA Services by Diagnoses (Columns A–E) and Type of Cost, FY 2008

	Neither A	TBI only ^a (CTE) B	PTSD only ^b		Both TBI and PTSD E	Statistical significance
			Negative TBI screen C	Positive TBI screen D		
Number	126,457	1,592	54,761	3,371	5,093	
Inpatient medical/ surgical	193 (3,738)	146 (1,639)	268 (3,196)	286 (3,110)	273 (2,342)	$p < .001$ for Column B vs. any other column; else NS
Inpatient nonmedical/ surgical ^c	286 (7,368)	724 (9,673)	1,282 (8,941)	1,755 (10,326)	2,673 (12,110)	$p < .05$ for Column B vs. C; else $p < .001$
Outpatient	1,993 (2,851)	3,976 (3,864)	4,503 (5,448)	5,710 (5,413)	7,010 (6,435)	All possible pairwise comparisons between columns $p < .001$
Total	2,472 (9,415)	4,846 (10,953)	6,053 (12,473)	7,750 (13,610)	9,957 (15,980)	All possible pairwise comparisons between columns $p < .001$

Note. Standard deviations are reported in parentheses following the mean annual costs.

^a TBI designations generally identify patients with mild severity although a small, unidentified subset have moderate severity.

^b For the "PTSD Only" category, we identified two groups of patients for FY 2008: those who also had a negative screen for TBI and those with a positive screen for TBI who later had the diagnosis ruled out in a comprehensive TBI evaluation (CTE). The costs for these subgroups are shown separately.

^c Nonmedical/surgical care includes psychiatric and long-term care.

individuals' symptoms diminish, they require reduced amounts of care and hence lower overall costs.

Differences in costs for veterans with mTBI and/or PTSD underscore the importance of ascertaining psychiatric problems for civilians with mTBI (Kamm, 2005). PTSD may be somewhat less common among civilians who experience some types of non-war-related mTBIs (e.g., sports injuries) because the threat to life will be absent; however, other civilian TBI sources (e.g., motor vehicle accidents, interpersonal violence) are associated with life threat and may be more likely to be associated with PTSD, as demonstrated by high rates of comorbid PTSD and mTBI in trauma centers (Bryant et al., 2010). In addition to the potential for PTSD comorbidity, civilian mTBIs may be associated with other conditions. For example, motor vehicle accidents are often associated with depression and/or anxiety (Mayou, Bryant, & Ehlers, 2001). Sports concussion injuries, especially in young athletes, may result in depression, although at lower rates than with other sports injuries (Mainwaring, Hutchison, Bisschop, Comper, & Richards, 2010). Physical accidents in the elderly resulting in mTBI are relatively common and correlate with mood changes, such as depression and anxiety (Goldstein, Levin, Goldman, Clark, & Altonen, 2001). These are just a few of the many attributes that the clinician needs to take into account when developing treatment plans. Treatment of physical ailments may be delayed or prolonged because of fatigue and irritability associated with patients' mental issues, which must be treated along with the more physical outcomes of the brain injury.

Direct Costs to Patients and Families

The costs described above are for medical and psychiatric treatment provided by VHA for veterans and is typically paid through health insurance for nonveterans. However, patients may still have medical and psychiatric expenses that are not covered by VHA or health insurance (e.g., over-the-counter medications, copays). In addition, patients and families bear other costs related to the care summarized above. Table 13.2 lists just a few major cost categories to the private-sector patient (including veterans who do not qualify for VHA services who must seek care in the private sector) and family for direct medical care for symptoms related to mTBI. Although these costs may appear small to a health care provider when weighed against the average direct medical costs reflected in VHA's experience with these patients, the costs may be large enough to prevent some patients from starting or continuing treatment for their mTBI and/or PTSD. This disincentive may be particularly strong for the nonmedical costs (e.g., for travel, child care, lost wages) that increase in direct proportion to the number of days that the patient comes to a provider's office for treatment.

TABLE 13.2. Costs to the Patient and Family

<ul style="list-style-type: none"> • Out-of-pocket medical expenditures <ul style="list-style-type: none"> ◦ With insurance <ul style="list-style-type: none"> —Over-the-counter medicines —Deductibles —Copayments —Self-help materials 	<ul style="list-style-type: none"> ◦ If items not covered by insurance <ul style="list-style-type: none"> —Glasses —Hearing aids
<ul style="list-style-type: none"> • Travel costs <ul style="list-style-type: none"> ◦ Gas ◦ Tolls ◦ Parking 	
<ul style="list-style-type: none"> • Child care 	
<ul style="list-style-type: none"> • Lost wages if time is taken from work 	

There are also potential intangible costs, many of which cannot easily be valued in dollar terms, if at all. A major intangible cost is the potential stigma at work or in the community if the service member seeks care for deployment-related conditions. Fear of stigma may cause some service members to try to "tough it out" instead of seeking help. This delay of care can result in cognitive, physical, and psychological problems getting worse (Brenner, Vanderploeg, & Terrio, 2009), which may be associated with increased health care costs when the patient does seek help. Additionally, the very symptoms of the conditions themselves may interfere with receiving care. For instance, Pietrzak, Johnson, Goldstein, Malley, and Southwick (2009) found that PTSD mediated the relationship between mTBI and perceived barriers to receiving mental health care. For some civilians with mTBI (e.g., athletes), the same value to "tough it out" may lead them to deny the extent of their symptoms and avoid treatment.

Components of Evidence-Based Treatments for mTBI and PTSD

Table 13.3 highlights some of the more common types of treatment that clinicians offer patients with mild/moderate TBI and PTSD along with a summary of the most common types of symptoms that are treated. Costs depend on who the payer is; therefore, the cost estimates in Table 13.3 should be viewed as illustrative of low-cost alternatives. We have been conservative in our estimates and used the lowest estimates for 2011 that were readily accessible and can be replicated by other health care economists. We used Medicare nonfacility (i.e., not in a hospital) professional fees for

TABLE 13.3. Outpatient Treatment Modalities for mTBI and PTSD with Estimates of Costs

Symptom	Treatment	Resources	Cost estimate
Mild TBI	Education	Printed material on symptoms/recovery Single session	\$15 \$35/individual
Headaches	Evaluation Medications	Appointment Sumatriptan 100 mg orally every day for 1-2 months	\$100-150 \$125
Sleep disorders	Medications for 3-6 months at bedtime	Ambien 5 mg Zolpidem Prazosin	\$75/2/3 months 5 mg \$23/3 months 5 mg \$22/3 months 1 mg
Visual problems	Evaluation Sunglasses	Appointment Prescription if needed	\$100 \$100
Hearing problems	Evaluation Hearing aid	Appointment Prescription if needed	\$100-150 \$1,500-2,000
Depression	Medications for 2-6 months	Sertraline 100-200 mg/day Citalopram 20 mg/day	\$24-88 \$14-42
Other emotional symptoms (e.g., irritability)	Evaluation Therapy	Appointment	\$75 or more per session
Neurocognitive dysfunction	Therapy with psychologist	1 outpatient session/week for 6-8 weeks Total of 6-8 sessions	\$150 per session \$900-1,200
Speech problems	Therapy	Varies with problem	Varies with treatments
Vestibular problems (e.g., balance problem, dizziness)	Vestibular rehabilitation	2 sessions/week for 6-10 weeks	\$75 per session \$900-1,500

(cont.)

TABLE 13.3. (cont.)

Symptom	Treatment	Resources	Cost estimate	
Pain	Physical therapy for low back pain	2 visits/week for 2 months (10-15 visits)	\$750-1,125	
	Medications	Ibuprofen 600 mg three times a day for 30 days	\$8/100	
		Naproxen 500 mg/day	\$8/100	
		Tramadol 50 mg/day Percocet 1 tablet three times a day for 2-3 months Epidural steroid injection	\$13/100 \$40/30 online/not available at Costco Varies by site (e.g., lumbar) and number of visits required	
PTSD	Education	Printed material on symptoms/recovery Single session	\$15 \$35/individual	
		Psychotherapy:		
	• CBT / CPT	Individual: 12 50-minute sessions	\$120/session = \$1,440	
	• PET	Individual: 12-15 90-minute sessions	\$156/session = \$1,875	
	• SIT	Individual: 8-15 50-minute sessions	\$120/session = \$960-1,800	
	• EMDR	Individual: 12 50-minute sessions	\$1,440	
	Anxiety, depression, flashbacks, nightmares	SSRIs:	• 12 weeks to assess initial response	Annual costs: \$92-88 (100 mg is less)
			• Medication management	\$38-114
			• Medication indefinitely if PTSD is chronic	\$110-240
			• HEDIS quality measure > 6-month treatment period	\$38-114

(cont.)

TABLE 13.3. (cont.)

Symptom	Treatment	Resources	Cost estimate
	Antidepressants	TCAs:	
		• Clomipramine 50 mg	\$28/100
		• Amitriptyline 100 mg	\$10/100
		• Desipramine 10 mg	\$105/100
		• Nortriptyline 50 mg	\$16/100
		• Doxepin 100 mg	\$11/100
		• Imipramine 50 mg	\$39/100
		MAOIs:	
		• Zelapar	\$1,051/120
		• Parnate 10 mg	\$173/100
		• Nardil 15 mg	\$173/180
	For nightmares	• Prazosin 1 mg	\$22/3 months

Note. CBT, cognitive-behavioral therapy; CPT, cognitive processing therapy; PET, prolonged exposure therapy; SIT, stress inoculation therapy; EMDR, eye movement desensitization and reprocessing; SSRIs, selective serotonin reuptake inhibitors; TCAs, tricyclic antidepressants; MAOIs, monoamine oxidase inhibitors; HEDIS, Healthcare Effectiveness Data and Information Set.

various evaluations and treatments for either condition, and the prices for medications charged by Costco, a low-cost retailer that makes its prices publicly available on the Internet (at www.costco.com/Pharmacy).

The cost estimates in Table 13.3 are not intended as an explanation for differences in the average costs presented in Table 13.1. Table 13.1 includes all care provided by VHA, much of which may not relate directly to either mTBI or PTSD. The VHA patients may have many comorbidities, both physical and emotional. In addition, the service-specific expenditures by VHA for its services in FY 2008 will also differ from those listed in Table 13.3, which illustrate psychosocial treatments and medications in 2011.

Several points are worth noting when evaluating Table 13.3. First, most patients do not need every type of treatment listed in Table 13.3. Total treatment costs will not be the sum of all services listed in the table, but readers can begin to understand the relative costs for different types or combinations of treatment for mTBI and/or PTSD. Second, many services in Table 13.3 have low annual costs, but if a patient with a chronic problem requires services every year, the cumulative costs can be expensive. Third, some services may consist of one course of intensive treatment with booster or refresher treatments in the future. Fourth, additional stressors and medical circumstances a patient faces over a decade or more will vary widely and affect actual health care costs as well.

Costs Associated with Different Models of Care

The list of services in Table 13.3 sets the stage for considering the costs of different treatment models. We first give an estimate for an outpatient program to treat mTBI and compare that with an estimate for outpatient therapy for PTSD. We note where savings are possible from combining the two types of treatment. We then summarize the impact of providing care on an inpatient versus an outpatient basis.

Estimating Program Costs

mTBI

The VHA, Center for Disease Control and Prevention, and Department of Defense stress in their Clinical Practice Guidelines that the vast majority of patients who have sustained an mTBI improve with no lasting clinical sequelae, but, in a small minority of patients, symptoms may persist beyond 6 months to a year (Veterans Health Administration, 2003, p. 7). The guidelines state that early education of patients and their families is the best available treatment for mTBI and for preventing or reducing persistent symptoms, an important factor in understanding the increased costs with insufficient initial intervention (Veterans Health Administration, 2003, p. 31). Given that mTBI treatment options are presented by Ponsford (Chapter 10, this volume), we will not highlight specific types of treatment initiatives.

The guidelines list headache as the single most common symptom associated with mTBI, and assessment and management of headaches related to mTBI should be similar to those for other causes of headache. The guidelines further indicate that treatment of other symptoms (e.g., somatic complaints and psychiatric symptoms) should be tailored to the patient's "symptom presentation" (Veterans Health Administration, 2003, p. 8). Providing patient education and offering treatment for headaches and other pressing somatic symptoms are relatively inexpensive and their treatment should be integrated with any comprehensive evaluation of the patient's condition so that he or she leaves the encounter with the health care system with some immediate understanding of the condition(s) (Lew et al., 2008). Further, sometimes there is not a single course of treatment, but options for helping address the symptoms that patient and provider need to consider collaboratively.

The cost of a half-hour of one-on-one education might be lower than \$50 in 2011 (Table 13.3). This cost estimate is based on distributing a book that discusses mTBI and its treatment and a nonphysician educator reviewing the material with the patient and answering questions. The book, such as those currently available at retail for \$15, might have to be purchased by the patient if the insurer does not cover it as a separate benefit, but

providers can undoubtedly make educational materials available at a lower cost than this estimate. Of course, the cost to the provider and the payment from the insurer (or the patient) would also be less if the educational session included several patients in a group.

The most costly treatments for symptoms associated with mTBI for veterans and other concussion patients alike include therapy for neurocognitive dysfunction, psychosocial treatments, family therapy, vocational counseling, and brand-name drugs for depression. As discussed by Ponsford (Chapter 10, this volume), instruction on compensatory strategies to work around attention and memory impairment may be necessary to assure that patients are able to maintain focus and learn in their other treatment episodes, including those for PTSD and depression. In many instances, the cognitive rehabilitation and psychoeducational approaches that may enhance continued gains in the postacute stages (McCrae, 2008) are not readily available to all patients (e.g., to students through school systems).

Costs are also affected by a patient's preference for specific medications and the specific clinical complaints. Although many generic drugs may be used for treatment of symptoms of depression, anxiety disorders, and PTSD, veterans may choose drugs not available through the VA pharmacy. This will increase health care costs as they are specially ordered through the pharmacy (for VHA patients). Newer drugs and alternative complementary medical treatments, such as acupuncture and yoga, traditionally not available within the VHA system (but provided in some medical centers) or covered by private health insurance are other unexpected costs to the health care system or to the patient and family.

PTSD

Initial treatment for PTSD is more costly than that for mTBI, because cognitive-behavioral approaches, such as cognitive processing therapy (CPT), prolonged exposure therapy (PET), and stress inoculation therapies, can require a few months or more to cover all the material and achieve results. Even at a minimal payment rate under the Medicare program, a course of CPT would likely cost around \$2,000. In addition to therapist wages, costs also include CPT handouts and materials, which are provided to patients within VHA and presumably in private-sector programs. These are relatively low costs, however, primarily resulting from printing materials and photocopying.

Coordination of Care

Providers can realize savings from coordinating care for mTBI and PTSD (what economists refer to as "economies of scope") and avoiding duplication

of certain types of care potentially required for both PTSD and mTBI (e.g., psychoeducation for the patient and family, treatment for sleep disorders, treatment/medications for depression, or polypharmacy more generally). This type of coordination of care is also key in reducing the costs borne by the patient and his or her family. Coordinated care reduces the total number of days required for receiving all of the treatments, reducing the time a patient has to take off work or away from family, cutting the costs of travel to and from the clinic, and decreasing costs for child care while the patient is away from home. These factors might increase the commitment and ability of some patients to participate fully in a treatment plan.

Inpatient versus Outpatient Programs

Another important difference in treatment models from a cost perspective is whether care is provided on an inpatient or an outpatient basis. The differences can be seen in both the costs covered by the payer and those borne directly by the patient and family. Inpatient care is more costly to the health care system than outpatient care because it requires coverage of room and board in addition to the treatment services and medications. Additionally, unlike outpatient services, inpatient care requires a proportion of the staff to be employed around the clock. The high costs associated with inpatient care contribute to insurers' policies of not covering inpatient care for some types of treatment. If the care is provided in a medical ward, room and board costs can be quite large, especially compared to the lower cost of having the patient stay at home and commute to the medical facility for care. However, special wards or units with less medical equipment and reduced medical supervision at night can reduce the room and board costs from more than \$1,000 a night to less than \$100 (even outside the VHA).

Long-Term Costs of Not Providing Treatment

If untreated, mTBI and/or PTSD may make future medical and psychiatric issues more likely (Brenner et al., 2009; Priebe et al. 2009), potentially adding to the costs of not treating the initial condition(s). For instance, a patient with untreated PTSD may turn to substance misuse as a way of managing his or her symptoms, which may evolve into substance abuse or substance dependence. Additionally, depression is common among individuals with mTBI and/or PTSD (Carlson et al., 2010; Tanielian & Jaycox, 2008). Both the initial mTBI and PTSD and the subsequent development of any additional, related disorders may affect physical health, which may lead to increased primary care and specialty care visits (Hoge et al., 2008; McCarthy et al., 2006; Schnurr & Green, 2004).

These conclusions are consistent with a longitudinal study of outpatient utilization and costs among veterans with TBI (Homaifar, Harwood, Wagner, & Brenner, 2009), in which about a quarter of the study population was classified as having sustained an mTBI. These patients had more primary care/internal medicine visits per year than those with moderate/severe TBI. For mild cases, the annual average cost increased with the time that had passed since the injury, but the analyses did not control for other conditions. Therefore, we do not know the long-term, direct medical costs associated with untreated mTBI. Additionally, we do not yet know the long-term effect of secondary impact syndrome when the brain is not given the time to recover between mTBIs. For PTSD, long-term costs are also not documented, but may well include repeated admissions for psychiatric or substance use disorders as well as exacerbations in chronic illness.

Occupational difficulties, including unemployment and few work hours, have been documented among individuals with mTBI (Dikmen et al., 1994) and PTSD (Smith, Schnurr, & Rosenheck, 2005). There is some evidence to suggest that untreated mTBI and/or PTSD symptoms contribute to familial and social difficulties (Milliken, Auchterlonie, & Hoge, 2007; Taft, Watkins, Stafford, Street, & Monson, 2011). Additionally, recent public health research has revealed that individuals from the OEF/OIF conflicts (with mTBI and PTSD and concurrent symptoms that reduce capabilities to maintain gainful employment) are more likely to become homeless and do so much sooner than individuals from prior conflicts (Gamache, Rosenheck, & Tessler, 2003).

The value of lost work productivity can be estimated in monetary terms from income flows by occupation, age, and education reported by the Census Bureau. The RAND simulations reported in Tanielian and Jaycox (2008) used wages and employment probabilities for veterans reported in the March 2007 Current Population Survey (p. 181) and reduced both measures for simulation subjects with PTSD and major depression based on the available literature, primarily Savoca and Rosenheck (2000). The impact of major depression was estimated to be about three times greater than for PTSD, reducing wages by over 45% compared to veterans without the condition.

There are currently no estimates of lost hours of work due to OEF/OIF or OND deployment-related injuries, although Hoge et al. (2008) reported that 23% of OEF/OIF military with mTBI missed 2 or more days of work due to illness in the prior month compared to 15% of those with other types of injuries and only 7% of those with no injuries. In a similar study, Hoge, Terhakopian, Castro, Messer, and Engel (2007) found that twice as many soldiers with PTSD missed 2 or more days of work due to illness in the prior month than those without PTSD (12% vs. 6.5%). Although the military might pay for the patient's retirement or the VHA might pay

compensation for a disability, neither amount represents what the person had hoped to achieve and neither compensates society for the loss of the person's productivity during his or her lifetime.

To make the simulations more concrete, suppose that a 22-year-old patient might expect to be earning \$30,000 a year in real estate or insurance sales. He or she might expect to earn \$1.8 million during his or her working life. If chronic PTSD made it difficult to maintain full-time employment or work at more than a laborer's job, the loss in income could easily be over a quarter of a million dollars over a working lifetime of 40 years. That amount represents not only a loss to the patient and family, but also to society as a whole, which forgoes the differences in the services that the patient could have been producing if he or she were not disabled.

How Cost Issues Affect Individual Clinical Decision Making

The information presented in this chapter underscores that the costs of clinical treatment for mTBI and PTSD depend on the course of treatment(s) and the patient's personal circumstances. As highlighted in Table 13.3, there are many treatments that can help alleviate postconcussive (e.g., dizziness, sleep problems, hearing impairments) (French, Iverson, & Bryant, 2011) and PTSD (e.g., flashbacks, nightmares, numbing) (Iverson, Lester, & Resick, 2011) symptoms. Receiving these treatments can help prevent postconcussive and PTSD symptoms from becoming chronic or leading to other conditions that require hospitalization and further disability, which carry a heavy economic burden for health care systems and the patient.

The targeted outcomes of mTBI and PTSD treatment should include reintegration of the patient into his or her life in terms of successful job performance, ability to function in one's family and social relationships, and enjoyment of everyday life activities. Indeed, in research concerning patients primarily with severe TBI, return to work is a major outcome measure, reflecting this goal for treatment (Wehman et al., 2003). Poor clinical outcomes represent costs that are borne by families (both spouse and children) as well as the patient. If the treatment outcomes do not include successful reintegration into one's life, the course of treatment has not really altered the costs to the patient and society. Further, it is not enough to keep the patient out of the hospital or focus only on symptom remission. Reclaiming one's life includes restoring the patient's cognitive and emotional functioning, as closely as possible, to former levels to ensure a similar level of work productivity and enjoyment of a positive quality of life.

Another implication of recognizing the importance of reintegration of the patient into his or her life is the need for psychoeducation early in the

process of treatment (French et al., 2011; Iverson et al., 2011). Psychoeducation includes providing information to the patient and his or her family members regarding the nature of mTBI and/or PTSD symptoms, and how such symptoms often occur on a spectrum. Not only is the patient helped by understanding what to expect, such information can help the patient understand and accept how he or she has changed as a result of the trauma(s), so that he or she can make informed decisions regarding treatment options that can help maximize functioning (Wilk & Hoge, 2010). Additionally, many family members desire family education (Sherman et al., 2009). Such programs can help family members feel less burdened and more effective in helping their loved ones, which can have a positive impact on their own health (Cuijpers & Stam, 2000; Hazel et al., 2004).

A health care system like VHA may realize some economies of scope in treating both conditions in an integrated manner, rather than sequentially. Improvements in emotional symptoms may be greater if physical or cognitive symptoms are addressed at the same time; likewise, physical conditions can improve with better mental health (Schnurr & Green, 2004). Dealing with both conditions will require the use of coordinators for the many types of care that the dually diagnosed mTBI/PTSD patients should be receiving. It has been suggested that coordinators for these patients can even be effective for arranging care across a variety of health needs, even those that are only indirectly related to mTBI or PTSD (Sayer et al., 2009). This effectiveness can come from cross-consultation and cross-education for providers in other care silos who may have less experience with these dually diagnosed patients.

Summary and Conclusions

Our overview of the health care costs associated with mTBI and/or PTSD clearly demonstrates the significant burden of these conditions on the health care system, the patient, and the family. Health care systems and individual providers should be mindful of how symptoms from one disorder can impact treatment for the other disorder. Additionally, health care systems and individual providers should take care to ensure that both conditions are addressed. For instance, individuals with mTBI often complain of difficulty with attention and short-term memory, skills presumably important for cognitively based treatments for many psychiatric conditions, including PTSD (Sayer et al., 2009). Therefore, psychoeducation about the impact of mTBI on cognitive functioning, cognitive rehabilitation, and early interventions for diminished attention and short-term memory may improve treatment directed at emotional and physical symptoms (McCrae, 2008; Ponsford et al., 2002; Whittaker, Kemp, & House, 2007). Military and VHA

medical facilities offer treatment for these types of conditions, but the care may take place in separate clinics or departments, often with little coordination of care for individual patients (Sayer et al., 2009), which may lead to frustration on the part of the patient and maintenance of symptoms.

As noted earlier, the costs borne directly by the patient and family/friends during treatment (travel costs, lost wages, child care, etc.) will make it difficult for the patient to accommodate treatment for all the aspects of both mTBI and PTSD in a short time span, yet prolonged treatment also increases the cost for the patient. In recommending treatments, it is likely beneficial for the clinician to be aware of the patient's work and home circumstances and try to balance the indirect costs to maximize the patient's ability and willingness to adhere to a treatment plan. Telehealth and web-based interventions can potentially reduce the number of trips to the office of providers and also improve treatment compliance. For example, there is promising data supporting the use of such interventions for PTSD (Greene et al., 2010; Lange et al., 2003; Litz, Engel, Bryant, & Papa, 2007). Clinicians will likely also find it helpful to inquire about potential treatment barriers and problem-solve these obstacles with the patient.

Clinical teams that can find ways to make treatment more easily available are likely to experience greater success with their patients and ultimately reduce the health care costs associated with mTBI and PTSD. For patients who work daytime jobs, evening or weekend clinics may substantially improve adherence to treatment and improve clinical outcomes, thereby reducing costs to the patient and the health care system. If a health care system cannot accommodate the patients' needs, the patients will be much less likely to come for care, resulting in larger long-term costs. With improvement in clinical guidelines, diagnostic procedures, and treatment initiatives, it is likely that health care costs related to mTBI, PTSD, and co-occurring disorders will decrease.

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