Depression and Comorbid PTSD in Veterans: Evaluation of Collaborative Care Programs and Impact on Utilization and Costs

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Abstract

Depression and Comorbid PTSD in Veterans:
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Depressed patients with comorbid posttraumatic stress disorder (PTSD) are often more functionally impaired and more severely mentally ill than patients with depression alone. However, few studies have examined depression and comorbid PTSD in primary care settings. This dissertation describes three studies of depressed Veterans in primary care clinics across the U.S. Data were drawn from two group-randomized trials of collaborative care depression treatment: a multi-site trial in nine Veterans Affairs (VA) primary care clinics, and a second trial based in the Seattle VA General Internal Medicine clinic. The first, cross-sectional study, found that PTSD screen positive (PTSD+) depressed patients had more frequent mental health, primary care depression, and outpatient visits, and a higher proportion were prescribed antidepressants than PTSD screen negative (PTSD−) patients. PTSD+ patients had correspondingly higher mental health, primary care depression, outpatient, and antidepressant costs. The second study evaluated the effectiveness and cost-effectiveness of collaborative care depression treatment compared to usual care over 9 months. Under collaborative care, a mental health team developed an individualized treatment plan for primary care providers, a

social worker telephoned patients to enhance adherence, and suggested treatment modifications. In PTSD+ depressed veterans, there was a trend toward collaborative care improving depression symptoms and functioning but findings were not statistically significant. Collaborative care was associated with more depression-free days and moderately increased treatment costs. The third, pre-post comparison study, assessed whether depression care manager assessment, a crucial component of collaborative care, changed patients' knowledge and attitudes regarding mental health treatment among PTSD+ depressed veterans. The depression care manager assessment was a 45-minute phone intervention monitoring patient symptoms and problem-solving around treatment barriers. We found that this one-time assessment did not lead to greater knowledge, more positive attitudes towards depression treatment or less stigma in PTSD+ depressed veterans. As service members return from war, providers will see more patients with PTSD and depression and can expect increased outpatient and mental health services use and costs. There were some indications from these studies that collaborative care may be an effective treatment approach for depressed patients with PTSD, but more research is needed to confirm these trends.

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Glossary

CDS	Chronic Disease Score
CI	Confidence Interval
COVES	Cost and Value of Evidence-based Solutions for Depression Study
DCM	Depression Care Manager
DSS	Decision Support System
IRR	Incidence Rate Ratio
NVVRS	National Vietnam Veterans Readjustment Survey
OPC	VA Outpatient Care File
OR	Odds Ratio
PBM	VA pharmacy benefits management system
PHQ-9	Patient Health Questionnaire- 9-item scale
PTSD	Posttraumatic stress disorder
PTSD+	Posttraumatic stress disorder screen positive
PTSD−	Posttraumatic stress disorder screen negative
QALY	Quality-adjusted life year
SCL	Hopkins Depression Symptom Checklist
SD	Standard Deviation
SIC	Seattle Comorbidity Index
VA	Veterans' Affairs/Veterans Administration
VAMC	Veterans Affairs Medical Center
WAVES	Well-Being Among Veterans Enhancement Study

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Chapter One: Introduction

I. INTRODUCTION

Depression and post-traumatic stress disorder (PTSD) are two debilitating mental disorders, which have been shown to be independently associated with high health care service use and poor medical and psychiatric outcomes [1-3]. In addition, PTSD and depression have been shown to be associated with diminished work productivity and increased absenteeism [3-5]. Depression and PTSD often co-occur [6, 7], contributing to greater functional impairment and distress [8].

Most depression treatment takes place in primary care,[9] yet there are numerous problems of diagnosis and treatment of depression in primary care. First, about half of patients with major depression are not diagnosed [10, 11]. Second, clinical guidelines for depression treatment including antidepressant treatment are not followed. Third, there is overuse of health care services due to diagnostic testing for medically unexplained physical symptoms, such as headache and abdominal pain, somatization and/or a compromised immune system that are caused by depression [1, 12].

Detecting and treating depression and comorbid PTSD in primary care is of great importance to the veteran population. Depression and post-traumatic stress disorder (PTSD) are highly prevalent chronic illnesses in veterans that are associated with major functional impairment and high health care costs [13, 14]. Evidence suggests that medically ill veterans with comorbid depression and PTSD are more psychological distressed and use more mental health services than patients with depression alone or PTSD alone[15]. Veterans with comorbid depression and war-related PTSD are possibly less responsive to treatment compared to those

with depression alone[16]. Thus, this population may need more intensive treatment and more monitoring than patients with depression alone.

Collaborative care depression care interventions are multi-faceted multidisciplinary team-based disease management programs based on Wagner's Chronic Care Model (See Figure1)[17]. Collaborative care programs have been shown to be effective [18-22] and cost-effective [23-32]. The collaborative care treatment model incorporates interventions at the patient, provider, and system levels. These include clinical guidelines for depression care, patient education and self-management support through active sustained patient follow-up, provider education and expert support, decision-support systems, as well as collaboration and involvement of senior leaders. Not all collaborative care models are equal; they can vary in their components. For instance, collaborative care models for depression treatment often vary in the composition of their multi-disciplinary teams and how mental health is integrated with primary care. Integrating mental health and primary care, and implementing Veterans Affairs (VA) depression guidelines are major priorities in the VA. VA is in the process of implementing collaborative care regionally to improve depression care in primary care and is planning for national rollout.

Data collected are from two collaborative care intervention studies that examine the effect of collaborative care among depressed primary care patients screened positive with PTSD in the VA system. The first study is Project Mood, a clinical trial examining effectiveness of collaborative care, in which 354 depressed patients were enrolled and randomized by provider group. The second study is an ongoing implementation study, which evaluates the implementation of a collaborative care intervention called Well-Being Among Veterans Enhancement Study (WAVES). Table 2 (p.18) describes the differences between these two studies and differences in the collaborative care interventions in the two studies.

II. SPECIFIC AIMS

The specific aims of the dissertation are:

Utilization

1. To examine the association of comorbid PTSD with increased likelihood of health services utilization among depressed VA primary care patients. The health services utilization includes the following: primary care visits, mental health visits, total outpatient visits, inpatient admissions, antidepressants, and other prescriptions filled.
2. To examine the association of comorbid PTSD with increased costs of VA health services among depressed VA primary care patients. The cost of VA health services includes depression-related treatment costs, total outpatient care costs, and total costs that include inpatient, outpatient, and medication costs.

Effectiveness

1. To evaluate the effect of collaborative care depression treatment on depression severity and functional status among depressed VA primary care patients who screened positive for PTSD compared to PTSD screen negative patients.
2. To examine cost-effectiveness of collaborative care treatment for depression among depressed VA primary care patients who screened positive for comorbid PTSD.
3. To examine if depression care manager assessment, a key part of collaborative care, results in increased depression knowledge and more positive attitudes and beliefs towards depression treatment compared to non-assessed patients among older primary care veterans who screen positive for PTSD.
4. To examine if depression care manager assessment is associated with increased patient satisfaction compared to non-assessed patients among veterans who screen positive for PTSD.

III. BACKGROUND AND SIGNIFICANCE

Depression and PTSD are two debilitating mental disorders. Major depressive disorder symptoms include a patient having low mood and/or loss of major interests/pleasure for at least two weeks. A person must also experience several of the following symptoms: changes in appetite or weight, changes to sleep- either insomnia or oversleeping, difficulty concentrating or making decisions, moving or speaking slowly or being fidgety or restless, and excessive fatigue almost every day or most of the day. PTSD is a debilitating chronic anxiety disorder that follows tremendously stressful traumatic events, such as combat, sexual assault or natural disasters. Symptoms must exceed one month in duration and include reliving the trauma in dreams, numbness and lack of involvement with reality, recurrent thoughts and images, or being extremely watchful and alert [33].

A. Prevalence of Depression

Depression is one of the most common health conditions treated in primary care [34]. The prevalence of major depression ranges from 5% to 10% in the general primary care population [34, 35]. Lifetime major depression prevalence was estimated at 16.6-17.1% in the general population [36, 37]. Depression is associated with major functional impairment, loss of productivity and higher health care costs [4].

B. Depression in Veterans

Among veterans, major depression is the second most prevalent medical condition, approximately 31% of outpatients suffer from depression [13]. This is much higher than the general population estimate of 17% [36, 37]. A recent study of returning Afghanistan and Iraq War army soldiers and marines assessed 3-4 months after their return from combat duty found that deployment to Iraq or Afghanistan was associated with an increased likelihood of depression (Odds Ratios 1.3-1.4) and depression rates ranging from 14.2-15.2% [38]. Thus,

depression diagnosis and treatment in primary care is particularly important to VA because a large number of primary care patients suffer from depression as well as other medical illnesses. In addition, many Veterans are reluctant to see mental health specialists because they are afraid of possible stigma [38]. Increasing depression screening and treatment in primary care could be one important way to address the problem of stigma.

C. PTSD

Following a traumatic event, a high proportion of survivors will develop acute symptoms of PTSD, which may dissipate within a short time. In about 10-20% of these survivors, these symptoms may develop into chronic and persistent PTSD. PTSD is a disabling condition that results in more loss of worker productivity compared to those who are not mentally ill in the general primary care population [3]. PTSD prevalence estimates vary based on the population studied (community vs. clinic sample, or general population vs. military veterans) and the instruments used to assess trauma and PTSD. PTSD prevalence has been reported in non-VA primary care settings ranging between 11.8% to 38.6% [3, 39]. The lifetime prevalence of PTSD is 6.8% to 14% in the general population [7, 36]. In addition, the changing DSM-III to DSM IV diagnosis in 1994 also can impact prevalence estimates as the DSM-IV broadens the range of traumatic events.

D. PTSD in Veterans

PTSD is more prevalent in war veterans than other groups. Prevalence is higher for veterans exposed to combat trauma with current PTSD prevalence (up to 20%)[13] and lifetime (up to 31%) [40]. The National Vietnam Veterans Readjustment Survey (NVVRS) reported that approximately 25% of U.S. Vietnam veterans were suffering from PTSD in the early 1990s. However, this study has been criticized as overestimating PTSD prevalence. A recent reanalysis of the data by Dohrenwend et al (2006) confirmed this suspicion and recalculated

the PTSD prevalence as 9.1% and as 5.4% if clinically significant functional impairment was required [41]. Veterans on disability had higher symptom levels of PTSD than employed veterans treated in VA primary care clinics [14].

A recent study found that soldiers and marines returning from the Gulf War were significantly more likely to report that they were currently experiencing an emotional health problem, to express interest in receiving help and to use mental health services compared to those soldiers returning from Afghanistan or those assessed before deployment. The prevalence of PTSD for Gulf War veterans was 12.6%; about double the 6.2% PTSD prevalence in soldiers after deployment to Afghanistan and 5% PTSD prevalence before deployment [38]. Soldiers and marines who screened positive for mental disorders were twice as likely as those who screened negative to demonstrate concern about stigma and other barriers to mental health care and only 23-40% received professional care for mental health problems [38]. So, primary care screening and treatment for PTSD could be one way to address the problem of stigma and other barriers to seeking mental health care.

E. Controversy in Assessing Combat-related PTSD in Veterans

PTSD is a prevalent, complex and severe psychiatric disorder whose diagnosis requires a specific etiologic event: traumatic stressor exposure. According to the DSM-IV, Criterion A for PTSD requires that the traumatic event involved actual or threatened death or serious injury to self or others, and that the person's response involved intense fear, helplessness, or horror [42]. Trauma histories are difficult to accurately assess due to memory distortion in psychiatrically distressed individuals.

An important controversial issue is the "Phony Combat Veteran" [43]. This is the problem of deliberate exaggeration of symptoms in veterans seeking to obtain PTSD diagnosis. There is a strong incentive to apply for financial compensation for PTSD, as many

of 94% of veterans with PTSD do so [44]. Studies reviewing military records of Vietnam veterans suggested that some individuals fabricated their trauma histories (i.e. combat exposure) and their PTSD symptoms.[45] Burkett & Whitley [46] discovered a great deal of fraud with examples of some alleged combat veterans who never saw combat and some that never served in Vietnam. Thus, studies of combat-related PTSD could be contaminated by inclusion of participants who have lied about combat trauma. Burkett & Whitley suggest obtaining military records for PTSD subjects to verify self-reported traumatic events in combat-related PTSD. However, McNally et al 2007 and more recent analyses show that malingering may not be accounting for the high PTSD prevalence rate in NVVRS and that it could be due to other reasons [47]. First, DSM-III-R PTSD criteria, used in the NVVRS, did not necessitate that symptoms lead to impairment [47]. Some PTSD+ patients may have been highly functional, despite some occasional stress reactions. Second, some men assigned to non-combat duty (e.g., medics) may have been exposed to PTSD-inducing stressors[47]. Third, some individuals may have portrayed a Vietnam-PTSD story to make sense of postwar psychological problems with various causes unrelated to their military service [47].

Another strategy for assessment of PTSD involves psychophysiologic measures (e.g. heart rate, blood pressure, skin conductance). Psychophysiologic reactivity on exposure to a cue that resembles the traumatic event is a re-experiencing symptom of PTSD. Psychophysiologic studies have reported that patients with PTSD have substantially greater blood pressure and heart rate changes during traumatic cue exposure than those without PTSD. However, in a recent study by McNally et al (in press), individuals who reported false memories (alien abduction) exhibited heightened reactivity although they do not have PTSD. Thus, psychophysiologic reactivity confirms the emotional power of memory but neither the authenticity of the memory nor the presence of PTSD [48].

F. Policy implications

The main disadvantage to routine screening for PTSD in VA primary care settings is that it may encourage Veterans to "fake" or exaggerate PTSD symptoms in order to benefit from the current service-connected disability compensation program which acts as a disincentive to get well as veterans reapply to increase their disability ratings. The number of PTSD cases and PTSD-related compensation benefit payments rose dramatically during fiscal years 1999-2004. The number of veterans receiving disability compensation for PTSD grew by 79.5%, while the cases for all health problems increased by only 12.2%. The total number of PTSD benefits payments jumped by 149%, growing from $1.7 to 4.3 billion during this time period. The cost of health care used by veterans reporting PTSD was 20.5% of total health care payments for all disability payments; while only 8.7% of the total veterans who received compensation for service-connected disability reported PTSD [48]. As Iraq War Veterans return, PTSD rates are likely to climb [38]. Thus, increasing screening for PTSD without verification of trauma history or functional impairment could lead to further escalation of legitimate PTSD-related disability payments as well as potentially fraudulent cases.

G. Prevalence of Comorbid PTSD and Depression

PTSD commonly co-occurs with other psychiatric disorders such as major depression, anxiety disorders and substance abuse which may obscure its detection and diagnosis particularly in primary care. Although depression and PTSD are common disorders, they both continue to be underdetected and underdiagnosed in the primary care setting.[11, 49-51] Among veterans with current PTSD, rates of comorbid major depression range from 29% to 68% (see Table 1).[52 16, 53, 54] Studies have reported the prevalence of current PTSD in patients with depression range from 43% in hospital emergency room patients[55] to 61% in a general primary care population.[3, 7]

Table 1: Prevalence and Co-Occurrence of PTSD and Depression

	Range of Depression Lifetime Prevalence	Range of PTSD Prevalence	Range of comorbid Depression & PTSD prevalence
Non-Veterans	17-18%	8-38%	43-85% PTSD patients with Depression
Veterans Mental health patients	29-31% 68%	20-25% 82%	36-51% Depressed patients w/ PTSD[7, 56]

H. Impact of Depression and Comorbid PTSD

Patients with comorbid depression and PTSD are more functionally impaired, have more severe depressive symptoms and have a more complicated and persistent history of mental illness than patients with depression alone or those with PTSD alone.[57, 58] In addition, patients with comorbid depression and PTSD have higher rates of suicidal behavior compared to depressed patients without PTSD.[59] Motor vehicle accident victims with PTSD and major depression were more distressed, suffered more major role impairment, and recovered less readily over the first 6 months than those with PTSD alone [8].

Depression symptoms are often associated with higher health care costs and utilization in both veteran and general populations [60]. Similarly, studies have also shown that patients with PTSD have higher medical utilization than other patients [61]. Adequate diagnosis and treatment of these often comorbid conditions could lead to decreased mental health and other non-depression related medical costs (cost-offset) [62]. Furthermore, there is little existing evidence on the effectiveness of depression treatment for primary care patients with depression and comorbid PTSD.

I. Depression Treatment in Primary Care

The majority of depressed persons are seen in primary care and many patients prefer to seek depression care within a primary care setting due to stigma about mental illness. Persons with mental disorders are more likely to seek help from non-psychiatric providers

rather than a mental health professional [63]. However, depression remains under-detected and under-treated in primary care and the potential for recognizing and treating patients at early stages of mental illness is largely untapped.

Katon outlined several barriers to effective depression treatment and quality improvement in primary care at various levels of the health care system [64]. At the patient level, there is a lack of knowledge about depression and treatment options, negative beliefs about psychotropic medications, stigma about mental illness, and reluctance to seek treatment because mental illness is considered to be a personal or family problem. Patient beliefs about medications are important factors that contribute to depression treatment initiation, acceptance and adherence [65-67]. At the provider-level, there is a lack of close monitoring and follow-up of patients between infrequent visits, lack of time to educate or counsel patients during hurried office visits as well as complete reliance on physicians to manage treatment. At the organizational/systems level, problems include a lack of emphasis on quality improvement, lack of appropriate information technology systems, failure to align incentives for clinical systems with quality improvement, and/or lack of leadership development in quality improvement methods.

J. Efficacy of Collaborative Care Treatment for Depression

To overcome these problems on multiple levels, multi-faceted disease management programs were developed. Collaborative care is based on a chronic care model in which multidisciplinary care teams assist primary care providers to deliver evidence-based depression treatment (see Figure 1). Typically, the comprehensive collaborative care approach includes the following: 1. a care plan is established with the patient that includes goals and implementation plans, and 2. a clinically trained care manager, usually a masters-level health professional, assesses the patient, monitors and follows the patient, provides support for

behavioral/cognitive change and encourages adherence to treatment, such as medication compliance. Cognitive changes could include more positive beliefs towards depression treatment and increased perceived need for treatment. However, the way of coordinating between primary and mental health care and monitoring by care managers may vary across different interventions. Other features of collaborative care interventions often include patient education to increase knowledge about depression and depression treatment, provider education on depression diagnosis and treatment, and other systems-level improvements in coordination of depression care. Randomized trials have experimented with several types of collaborative care interventions: 1) integration of mental health professionals; 2) integration of nurses or other allied health professionals; and 3) integration of a mental health team with nurses and/or masters-level therapists who provide patient support with supervision by a psychiatrist. These studies have shown that collaborative care interventions have significantly improved the process and outcomes of depression care [19, 68]. Previous studies have shown that a stepped collaborative care intervention resulted in small to moderate improvements in social/role functioning for primary care patients with depression [69]. and improved productivity and more days employed compared to usual care [70]. Previous studies have not examined the behavioral and cognitive effects of depression care management in collaborative care.

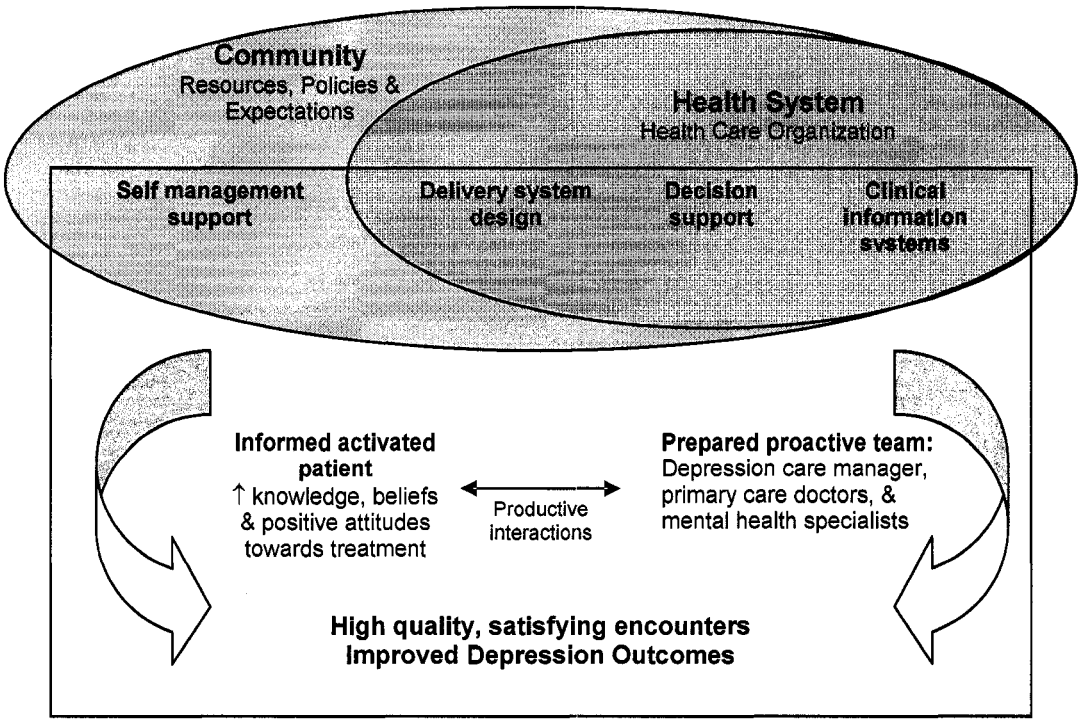

Figure 1 Wagner Chronic Illness Care Model adapted to Collaborative Care Depression Treatment

16,71

K. Collaborative Care and PTSD

There is only one recent study examining the effect of collaborative care treatment among depressed older adults with comorbid PTSD[72]. This study found that patients with comorbid PTSD were slower to respond to the intervention. Forty-nine percent of patients with comorbid PTSD showed clinically significant improvement in depression symptoms at 12 months comparable to those without comorbid PTSD, whereas patients without comorbid PTSD had early and lasting improvements in depression compared to those in usual care. One weakness of this study was that it did not use a validated PTSD screener to screen for PTSD in their primary care population. One strength of this study was the sample size of 1801 older adults with depression.

L. Cost-Effectiveness of Collaborative Care

Adoption of the collaborative care model for depression treatment will depend on the balance of clinical benefits (effectiveness) and costs. Several previous studies on collaborative care treatment programs have an increase of annual depression treatment costs range from $200 to $600 more per patient [70, 73, 74]. Recent studies suggest that collaborative care results in moderate increases in days free from depression, modest increases in treatment costs, and is generally cost-effective compared to usual care [29-32, 70, 73].

M. Significance and Summary

Though collaborative care has been shown to be effective to improve depression treatment in primary care, it is unclear about its effect among depression patients with comorbid PTSD. Few studies have examined the effectiveness or cost-effectiveness of collaborative care among a population of primary care patients comorbid depression and PTSD. Information on the effectiveness of collaborative care in depressed patients who screen positive for PTSD can inform medical providers on screening and treatment decisions in the primary care setting. In addition, information on cost-effectiveness of treatment can assist policy makers and administrators to weigh the costs and outcomes of treatments to inform their administrative and clinical practice decisions. Information on attitudinal changes resulting from depression care management can assist us to understand if care management works according to collaborative care theory.

This dissertation will examine the effectiveness and cost-effectiveness of two collaborative care interventions in the VA systems. This is especially important since the prevalence of PTSD and depression is higher in veterans than in the general population. There is lack of research in assessing the effect of collaborative care for depression treatment among depressed primary care patient with comorbid PTSD in the veteran population.

This is especially important because a new generation of veterans returning from Afghanistan and Iraq conflicts will be entering the VA system. It is expected that these veterans will experience depression and PTSD. The study on effectiveness and cost-effectiveness will provide important information to clinic managers and policy-makers in decisions of adopting collaborative care to treatment of depressed primary care patients with comorbid PTSD.

In summary, there is substantial evidence indicating that collaborative care for depression treatment in primary care is effective for both veterans and general populations. The two collaborative care interventions provide a unique opportunity to evaluate the burden of comorbid depression and PTSD on health care utilization and costs; to examine the effectiveness and cost-effectiveness of collaborative care for depression treatment; and to evaluate the impact of depression care manager assessment on depression treatment knowledge and attitudes among depressed primary care veterans with comorbid PTSD.

N. Conceptual Model

Figure 2 presents a conceptual model outlining proposed factors that influence health services utilization, costs and outcomes of depressed veterans with comorbid PTSD in primary care based on the literature on PTSD, depression and collaborative care and adapted from Andersen's Behavioral Model for vulnerable populations [75]. The model shows that Predisposing, Enabling and Need factors lead to Health Behaviors which lead to health outcomes. Health Behaviors consist of personal health behaviors as well as health care utilization behavior. Predisposing factors include demographic characteristics, such as age, gender, marital status, education, employment and family size. The predisposing vulnerable domains include previous trauma, living conditions, mobility, mental illness, and substance abuse. The Enabling domain includes personal/family resources including income and health

insurance, as well as community resources. The Need domain includes self-perceived need and evaluated need (from objective evaluation). However, when we are interested in use of health services, mental illness falls in the Need domain. The Outcomes domain includes perceived and evaluated health status as well as health care satisfaction.

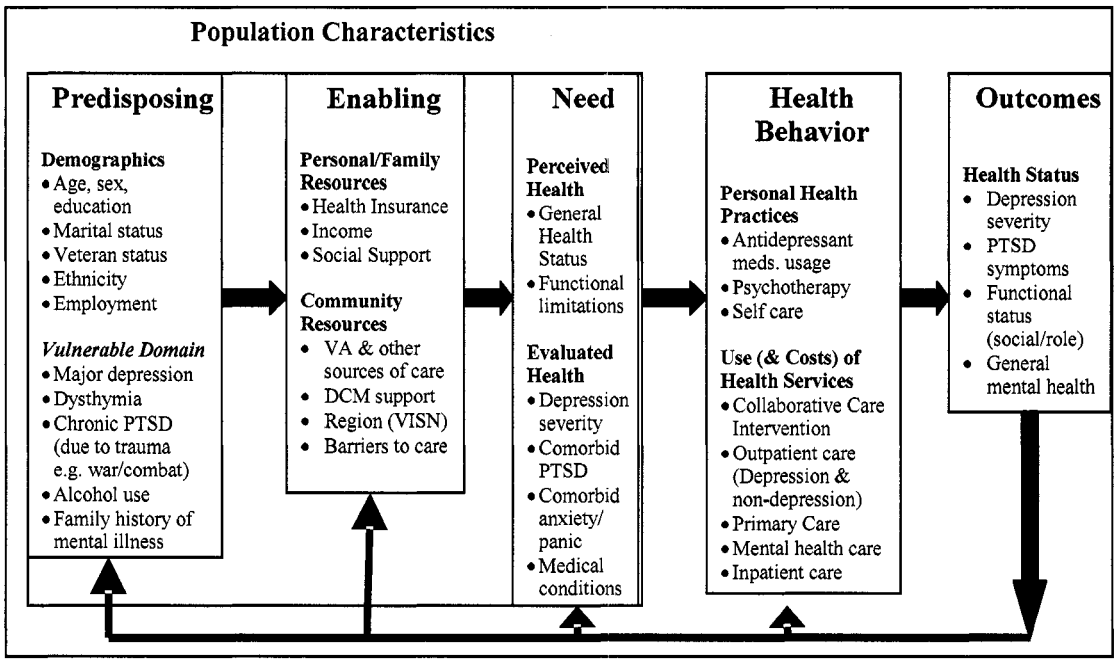

Figure 2 Behavioral Model for Veterans with Depression and PTSD

The three dissertation papers are:

1. Paper 1: *Health Care Utilization and Costs of Depressed Veterans with comorbid PTSD.* Paper 1 explores the association of depression and comorbid PTSD (Need Domain) with increased health services utilization (depression-related primary care visits, outpatient visits, mental health visits, inpatient admissions and medications filled), controlling for individual characteristics (Predisposing domain) and other health care insurance and barriers to care (Enabling factors). The paper also explores the association of depression

and comorbid PTSD with increased health care costs. This is shown in the conceptual model (See Figure 2).

2. Paper 2: *Effectiveness and Cost-Effectiveness of Collaborative Care for Depressed Veterans with PTSD in Primary Care.* The model shows my hypothesis that collaborative care treatment for depression (Health Behavior domain) improves health outcomes among depressed patients with comorbid PTSD. Outcomes were measured as depression severity (SCL scores) and social/role functioning was measured by Sheehan Disability Scale. I hypothesized that collaborative care will impact costs for these patients by increasing some mental health–related visits/costs and by decreasing overall health care costs compared to patients under Usual care. This paper also explores the cost-effectiveness of collaborative care (i.e. if the incremental benefits outweigh the incremental costs) for depressed PTSD+ patients.
3. Paper 3: *The Impact of Depression Care Management on Attitudes Toward Depression Treatment Among Depressed Patients with PTSD (WAVES)*

   Again the conceptual model illustrates my hypothesis that depression care manager support is a "Community Resource" in the (Enabling Factors domain) which leads to greater change in patients' knowledge, attitudes and perceptions of his/her health (Need domain) in those patients assessed by the depression care manager. Cognitive/ attitudinal changes such as perceived need for treatment and attitudes about depression treatment are important precursors for health-seeking behaviors. Depression knowledge, beliefs and attitudes were measured by a 7-item measure along with one question on stigma. Patient satisfaction for emotional health services was also assessed.

IV. METHODS

A. Data Collection

To meet these aims, I analyzed two secondary datasets: one is a cluster randomized trial of collaborative care in a general internal medicine clinic in a Seattle Veterans Affairs (VA) medical center, randomized by provider group (Project Mood); the second dataset is from a multi-site implementation study of Well-being Among Veterans Enhancement Survey (WAVES). Table 2 describes the data collected for these two studies. Patient flow charts outlining study samples are in the appendices. I was not involved in primary data collection. I conducted secondary analyses from data outlined below. These analyses were developed for my dissertation and were not related to my VA employment.

Table 2: Comparison of Data Sources Used in Dissertation

Projects	Project Mood (1998-1999)	Well-being Among Veterans Enhancement Survey (WAVES) (2003-2005)
Dissertation-Related		
For use in Papers	Paper 2	Paper 1 and 3
Chan's Study Population	Patients with depression and dysthymia who answered PTSD screening questions (N=342). Excluded 9 patients who reported taking lithium/tegretol/ depakote in past 6 months (N=333)[a]	**Paper 1:** 761 patients with depression and dysthymia excluding 84 patients with bipolar disorder & 71 patients with no administrative data (N=606 at baseline) **Paper 3:** Excludes control group n=375; n=98 Loss to follow-up; PTSD− n=183; (N=104 PTSD+ Collab. Care only).[b]
Summary of Studies/Data Sources being used		
Sites/ Participants	**Site:** Seattle VA General Internal Medical Clinic. Two providers groups were randomly assigned to collaborative care and two were assigned to usual care. **Participants**: Patients with depression or dysthymia. Excluded patients with acute suicidality, active psychosis, primary PTSD or alcohol abuse or very ill. (N= 354) Follow-up at 3 & 9 months	**Sites**: 6 collaborative care clinic sites and 3 control sites across the U.S. (OH, SD, FL, TX, MN). **Participants:** Patients with depression or dysthymia. Excluded suicidal patients. (N=761 at baseline, N=541 at 7 mo) Follow-up at 7 months.
Specific Aim/Major Findings	**Aim:** To evaluate the effectiveness of collaborative care. **Findings**: No difference in SCL depression severity between collaborative care and control groups at 9 months. Depression symptoms improved for collaborative care patients but not for control patients at 3 months.	**Aim:** To evaluate the implementation of collaborative care across multiple sites. **Findings:** Study in process. No difference in depression symptoms between collaborative care and usual care at 7 months.
PTSD Screen Citeria	VA PTSD Screening tool: PTSD+ = 2 of 3 PTSD symptoms (55% patients PTSD+)[c]	PC-PTSD screening tool: PTSD+ = 3 of 4 PTSD symptoms (36% patients PTSD+)[d]
Collaborative Care Intervention	Integrated treatment team assessed patients and provided treatment advice to providers. Social worker care managers monitor and support patients under supervision of mental health team. Provider and patient education.	Nurse care managers monitored and supported patients under psychiatrist's supervision. Provider education and use of clinical information system to disseminate information.
Data sources	Survey data collected by phone interviews for demographic and patient reported measures. VA administrative databases for outpatient, inpatient, medication utilization and cost data.	Survey data collected by phone interviews for demographic and patient reported measures. VA administrative databases for outpatient, inpatient, medication utilization and cost data.

[a] See Appendix I, [b] see Appendix II, [c] see Appendix III, [d] see Appendix IV.

Chapter Two: Health Care Utilization and Costs of Depressed Veterans with Comorbid PTSD

I. CHAPTER SUMMARY

This study examines whether depressed Veteran's Administration (VA) patients who screened positive for posttraumatic stress disorder (PTSD+) had greater health care utilization and costs than PTSD negative (PTSD−) patients. Cross-sectional comparisons of utilization and costs were conducted using VA administrative data from a randomized trial of collaborative care depression treatment in nine VA primary care clinics. Results showed that PTSD+ depressed patients had more frequent mental health, primary care depression, and outpatient visits than PTSD− patients. More PTSD+ depressed patients were prescribed antidepressants than PTSD− patients. PTSD+ patients had correspondingly higher mental health, primary care depression, outpatient, and antidepressant costs.

II. INTRODUCTION

Posttraumatic stress disorder (PTSD) among Iraq war veterans is a severe and growing problem with potentially significant consequences for staffing levels and budgets within the Veterans Administration (VA) mental health system. One important subgroup within those with PTSD is veterans who also have symptoms of depression. Among veterans with current PTSD, rates of comorbid major depression range from 29% to 68%[16, 52-54]. Among veterans with depression, rates of comorbid PTSD are estimated at 36% to 51% [7, 56]. Among female veterans with depression rates of comorbid PTSD have been estimated as high as 77% [76]. Veteran's Administration (VA) clinical practice and guidelines treat depression and PTSD as distinct disorders with different causes and treatment indications. Some studies have

found that depression and comorbid PTSD often co-occur and are correlated, yet separate, responses especially in the acute aftermath to trauma [8, 77]. However, over time in the chronic phase after trauma, PTSD and depression symptoms appear more similar, overlap significantly and thus may be indistinguishable symptoms of general traumatic stress [77].

Patients with depression and PTSD are more functionally impaired, have more severe depressive symptoms and have a more complicated and persistent history of mental illness than patients with depression alone or PTSD alone [57, 58]. In addition, patients with comorbid depression and PTSD have higher rates of suicidal behavior compared to depressed patients without PTSD [59]. They are also more distressed, suffer more major role impairment, and recover more slowly than those with PTSD alone [8].

Depression has been consistently associated with higher health care costs and utilization in both veteran and general populations [60, 78, 79]. Most studies have also shown that PTSD patients have higher medical and surgical inpatient and outpatient utilization for physical problems compared to non-PTSD patients [40, 61, 76, 80]. PTSD has been associated with predicting higher health care costs for physical problems and mental health comorbidities [81]. PTSD and depression were shown to independently predict costs of mental health care and pharmacy services in Gulf War veterans with medically unexplained physical symptoms [82]. However, few studies have examined the association of depression and the added comorbidity of PTSD with health care utilization and costs. Campbell et al 2007 [56] found that PTSD screen positive depressed patients were more likely to report more frequent outpatient visits compared to PTSD screen negative depressed patients using self-reported utilization data. Therefore, this study is among the first to examine the association between PTSD symptoms, health care utilization and costs in a sample of VA depressed primary care patients using VA administrative data. We will evaluate whether depressed patients who screen PTSD positive

(PTSD+) have greater health care utilization, antidepressant use, and costs than PTSD screen negative (PTSD−) depressed patients in the 12 months prior to study enrollment.

III. METHODS

This cross-sectional study compares health care utilization rates, antidepressant use, and costs over 12 months from a clinic-randomized intervention study of collaborative care for depression.

A. Setting and Participants

Study participants were from 10 VA primary care clinics across five states. In the parent study, three clinics were randomized to provide usual depression care and seven clinics were assigned to collaborative care depression treatment. This analysis includes baseline data on patients in both intervention and control clinics. The prevalence of PTSD+ patients among the parent study sample was previously reported as 36% [56]. Our study population included 606 veterans who received care between June, 2002 and June, 2003, including 216 PTSD+ and 390 PTSD− patients. Patients were screened by Patient Health Questionnaire 9-item measure (PHQ-9) (see Appendix VIII). Those with a positive screen of PHQ-9>10 met the criteria for depression and were included in the study. Acutely suicidal or bipolar screen positive patients were excluded. Screening, sampling and enrollment were described in Campbell et al 2007. However, in our sample 71 patients who did not consent to have administrative data collected were excluded.

B. Data Sources

The Well-being Among Veterans Enhancement Study (WAVES) survey – a 50 minute computer-assisted telephone interview that included questions about demographics,

mental health, physical health, and health care satisfaction. Survey measures used in the analysis included:

PTSD: Screening positive for current PTSD (PTSD+) was defined as having 3 out of 4 PTSD symptoms in the last 6 months on the Primary Care-PTSD (PC-PTSD) screen [83]. Patients with less than 3 out of 4 PTSD symptoms were considered PTSD negative (PTSD–). At this threshold, the PC-PTSD has a 0.78 sensitivity and a 0.89 specificity.[83]

Depression: Depression was assessed by the Patient Health Questionnaire, a 9-item measure (PHQ-9)[84]. Higher scores indicate more severe depression symptoms.

Covariates: WAVES survey also measured medical comorbidity, alcohol use, bipolar disorder screen, anxiety, panic symptoms, demographics, and social support. Comorbid chronic medical illnesses were assessed by the Seattle Comorbidity Index (SIC).[85] WAVES used the AUDIT-C screen to detect alcohol abuse [86]. The suicidal ideation measure was taken from the last item of the PHQ-9 depression scale. To assess current anxiety symptoms, patients were asked "During the last 6 months, have you felt anxious much of the time?" To assess panic attack symptoms, patients were asked "In the past 6 months, have you had a panic attack when you suddenly felt intense fear and discomfort?" Possible bipolar disorder, social support, and other measures are described in Campbell et. al., 2007 [56]. Barriers to health care were included as a possible confounder that would influence health care utilization. These included self-reported rating of time and effort for scheduling VA appointments and "getting to the VA for clinic appointments including arranging for childcare, elder care, transportation, driving, taking time off of work or rescheduling other activities".

Inpatient and outpatient utilization data were obtained from several VA administrative databases. Specifically, utilization data included inpatient admissions, outpatient visits and outpatient prescriptions filled. Outpatient visit data came from the VA Outpatient Care File

and inpatient data came from the VA Patient Treatment File. Antidepressant usage data were from the VA Pharmacy Benefits Management database.

Costs and health care visits were assessed over a 12 month period prior to the patient's study enrollment. The outpatient visit unit of analysis was defined as VA clinic "stops" or patient encounters with one or more health professionals within a clinic. Any outpatient care that was related to inpatient visits, such as post-operation care, was excluded. Primary care visits were defined by clinic stops for general medicine clinic, primary care, women's clinic, and geriatric clinics. Depression-related primary care visits were defined as encounters with a primary care clinic stop code and depression diagnosis. Depression diagnosis was defined as ICD-9 codes: 296.2x, 296.3x, 298.0, 300.4, 309.1, and 311. Mental health specialty visits included all mental health visits, including psychiatry, psychologist or social work visits, substance abuse clinic, and PTSD treatment. Mental health depression-related visits were categorized by the ICD-9 codes mentioned above. VA inpatient admissions were defined as any inpatient admission from the Patient Treatment File. If inpatient cost was missing, cost was replaced with mean inpatient cost for the diagnostic-related group. Medications data were obtained from the VA Pharmacy Benefits Management database. Antidepressant usage was defined as one or more prescription fills of psychiatric medications. Antidepressants below therapeutic daily dose levels were excluded. These therapeutic daily dose levels included: trazadone <300mg/day, amitriptyline <50mg/day and mirtazapine <45mg/day.

Health care costs were from the VA Decision Support System (DSS). DSS is a computerized accounting system that tracks health care costs at the patient level. Patient encounters include direct costs, such as provider time and supplies, and indirect costs, such as equipment and overhead. Costs include overhead assigned across departments.[87] All outpatient costs were matched to outpatient visits. Missing costs were replaced with average cost per

visit for the clinic. Inpatient costs from DSS were matched to inpatient admissions from the VA Patient Treatment File. Missing inpatient costs were replaced with average costs for the diagnostic-related group. Direct costs for medications, including antidepressant costs, were obtained from the VA Pharmacy Benefits Management database and adjusted to include indirect costs. All cost estimates were standardized to year 2005 dollars using the medical component of the consumer price index.

C. Analysis

Bivariate and multivariate analyses assessed health care utilization differences between PTSD+ and PTSD− patients over 12 months before study enrollment. Survey population weights based on age and gender were used to reflect the probability of participant entry to the study. In bivariate analyses, two-sample t-tests assessed differences between PTSD groups for continuous measures and chi-square tests detected proportional differences for categorical measures. Inpatient admissions were dichotomized because of low number of admissions. In multivariate methods for utilization variables, negative-binomial regression was used to analyze for primary care and total outpatient visits. Zero-inflated negative binomial regression was used to analyze mental health, primary care-depression, mental health depression visits because of the high number of zero counts for these variables and their overdispersed distributions. Statistical analyses used STATA 9.2 (College Station, Texas, 2005).

We summarized outpatient costs, medication costs, inpatient costs for those with inpatient admissions, and total costs. In multivariate methods for costs, generalized linear models with a log-link specified for a gamma distribution were used to account for the non-normal cost distribution. Regressions were adjusted for population weights and clinic clustering.

Several potential confounders were included in the multivariate analyses. Nearly all these variables were significantly different between PTSD+ and PTSD− patients (see Table 3). Several models restricted the number of covariates that could be included because of the small number of clinic clusters sampled. Potential confounders included in all of the models included: male, white, and chronic illness comorbidity (SIC). The negative binomial regression model also included age, depression severity, and on disability work status. The zero-inflated negative binomial regression models were chosen based on potential confounders and models with the lowest Akaike Information Criterion (AIC). These models used for mental health utilization also included age and depression score as covariates associated with any mental health visits or any mental health depression visits. The zero-inflated negative binomial regression model for primary care depression visits included age only in the inflation portion of the model and depression severity as a covariate associated with number of primary care depression visits. Logistic regression multivariate models also included age, marital status, and disability work status. For cost data that was analyzed using a one-part GLM model log link with gamma distribution, we adjusted for population weights, probability of enrollment, clinic clustering and also adjusted for age, college or more education, unemployment, on disability, retired, marital status, living alone, alcohol use (AUDIT_C), total social support, non-VA health insurance, effort to schedule appointment, effort to go to appointment.

IV. RESULTS

A. Patient Characteristics

Table 3 shows that PTSD+ depressed patients were more likely to be younger, non-white ethnicity, have a higher education level, be on disability, and were less likely to have

non-VA health insurance compared to PTSD− depressed patients. PTSD+ depressed patients also had slightly lower chronic illness comorbidity, less social support, higher depression severity, more frequent suicidal thoughts, and more anxiety and panic attacks than PTSD− patients.

Table 3: Bivariate comparisons: Demographic and illness characteristics by PTSD screen status in a depressed primary care veteran population [a]

Characteristic	PTSD Screen Positive (n = 216)	PTSD Screen Negative (n = 390)	*p* [b]
Age			
<55	35.4	14.4	<.001
55-64	41.0	25.5	
65+	23.5	60.0	
Male (%)	94.0	96.7	0.084
White (%)	80.3	89.9	0.001
Married (%)	61.1	64.5	0.432
Living alone (%)	26.8	26.8	0.995
Education (educ3) (%)			0.009
High school graduation or less	45.5	57.1	
Some college or more	54.5	42.9	
Employment status (%)			<.001
Full-time or Part-time	15.3	13.3	
Unemployed	13.3	8.4	
On-disability	51.7	27.6	
Retired	19.7	50.7	
Other non-VA health insurance	26.7	73.3	<.001
Mean physical comorbidity: SIC (SD)	7.0 (6.0)	8.3 (4.0)	<.001
Alcohol Use (AUDIT-C)			0.248
0	50.5	59.1	
1-3	27.2	21.7	
4-7	14.8	13.2	
8-12	7.6	6.0	
Mean social support (SD) (rev. coded)	3.54 (2.1)	3.83 (1.4)	0.005
Mean depression severity: PHQ-9 (SD)	17.3 (7.6)	14.7 (5.0)	<.001
Suicidal thoughts (%)	40.7	21.5	<.001
Anxiety (past 6 months) (%)	83.4	50.2	<.001
Panic (past 6 months) (%)	66.2	21.9	<.001

Note. [a] Data are adjusted for population weights and probability of enrollment; [b] Significance testing included X^2 analyses for categorical data and t-tests for continuous data, as appropriate. S.D.− Standard deviation

B. Utilization

Table 4 presents bivariate comparisons of health care utilization by PTSD screen status over 12 months. PTSD+ depressed patients had more total outpatient visits 26.2 vs. 19.9 (P<.001) and more frequent mental health visits over the prior year 6.9 vs. 1.7 (p<.001), and than PTSD− patients, without adjustment. The mean number of mental health depression visits on averaged 0.66 more in PTSD+ than PTSD− patients (p=.002). Primary care utilization was not significantly different between the two groups. In unadjusted analyses, a higher proportion of PTSD+ depressed patients were prescribed antidepressants (61.2%) than PTSD− patients (40.4%). Inpatient utilization was not significantly different between the two groups. Bivariate unadjusted analyses of length of stay (data not shown) also did not indicate any differences between the two groups.

Table 4: Bivariate comparisons: Healthcare utilization for depressed veterans in primary care by PTSD screen [a]

Mean number of visits over past 12 months	PTSD+ (n=216)	PTSD− (n=390)	Diff.	95%CI	P[b]
Total outpatient visits	26.16	19.94	6.22	(2.8, 9.6)	<.001
Total primary care visits	4.42	4.15	0.27	(-0.29, 0.82)	0.347
Primary care depression visits	0.30	0.19	0.10	(-0.03, 0.24)	0.129
Mental health specialist visits	6.91	1.68	5.23	(3.66, 6.81)	<.001
Mental health depression visits	1.14	0.48	0.66	(0.25, 1.07)	0.002
Any inpatient admissions- n(%)	24 (11%)	39 (9.4%)	1.6%		0.543
Any antidepressant use-- n(%)	139(61.2%)	172(40.4%)	20.8%		<.001

Note. [a] Data are adjusted for population weights and probability of enrollment; [b] Significance testing included X^2 analyses for categorical data and t-tests for continuous data, as appropriate. **CI** – Confidence Interval

Table 5 presents unadjusted and adjusted utilization rate ratios for PTSD+ and PTSD− patients. For most utilization variables, results remained the same after adjustment for confounders. PTSD+ depressed patients had significantly more outpatient visits (IRR 1.25 p=.001) and more frequent mental health visits (IRR 1.72 p=.02). Also, PTSD+ depressed patients were more likely to use antidepressants than PTSD− depressed patients (Odds ratio 2.33; p<.001). Two comparisons changed with adjustment. First, PTSD+ screen became significantly positively associated with primary care depression visits after adjustment for confounders. Second, PTSD+ patients were still expected to have more mental health depression visits than PTSD− patients, but did not reach statistical significance after adjustment.

Table 5: Utilization rate ratios comparing PTSD positive and negative depressed veterans in primary care [a]

	IRR Unadjusted	P Unadjusted	IRR Adjusted	P Adjusted
Total Outpatient visits[b]	1.31	0.001	1.25	0.001
Primary care visits[b]	1.06	0.459	1.04	0.642
Primary Care Depression visits[c]	1.22	0.223	1.72	0.020
Mental Health visits[d]	2.55	<.001	2.59	<.001
Mental Health Depression visits[d]	1.47	0.029	1.34	0.110
	OR Unadjusted	**P**	**OR Adjusted**	**P**
Inpatient Admissions[e]	1.39	0.230	1.03	0.932
Antidepressant Use[e]	2.33	<.001	1.57	<.001

Note. [a] Data are adjusted for population weights, probability of enrollment and clinic clustering; [b] From negative binomial regression; adjusted model is adjusted for age, male, white, on disability, chronic illness comorbidity (SIC), and depression. [c] From zero-inflated negative binomial regression; adjusted model adjusts for male, white, SIC, depression score and inflation portion adjusted for age; unadjusted model inflated portion adjusted for age. [d] From zero-inflated negative binomial regression; adjusted models adjust for male, white, and SIC, and inflation portion adjusts for age and depression score; unadjusted model inflated portion adjusted for age and depression score. [e] From logistic regression; adjusted model adjusted for age, male, white, marital status, on disability, depression, SIC.
IRR – Incidence Rate Ratio, **OR** – Odds Ratio

C. Costs

Table 6 presents the adjusted and unadjusted costs comparing PTSD+ and PTSD− patients. Cost comparisons were consistent with utilization comparisons and most adjusted results were consistent with unadjusted findings. After adjusting for confounders, PTSD+ patients had significantly higher mean outpatient costs, $1399 (95%CI $1181, $1617; p<.001). However, the adjusted results for primary care visits differed from unadjusted results. After adjusting for confounders, PTSD+ patients had higher mean primary care costs of $94 (95%CI $73, $115; p<.001), including higher mean primary care depression-related costs of $59 (95%CI $32, $85) compared to PTSD− patients. These differences are fairly small.

Outpatient cost differences were mainly due to additional mental health costs of $1380 (95%CI $1173, $1588; p<.001), including higher mental health depression-related costs of $481 (95%CI $642, $334; p<.001) compared to PTSD− patients. PTSD+ depressed patients had on average $473 higher total medication costs (95%CI $361, $585; p<.001) and $199 higher antidepressant costs (95% CI $147, $251; p<.001) compared to PTSD− patients. Inpatient costs did not differ significantly between the two groups.

Table 6: Adjusted and unadjusted cost comparisons of PTSD positive and PTSD negative depressed patients

Mean costs ($) over past 12 mos	PTSD+ (n=216)	PTSD− (n = 390)	Unadjusted Difference[†]	95%CI	Adjusted Difference[‡]	95%CI
Total outpatient care costs	4257	3173	1084**	(460, 1707)	1399**	(1181,1617)
Total primary care costs	738	660	78	(-14, 171)	94**	(73, 115)
Primary care depression costs	49	30	19	(-1, 39)	59**	(32, 85)
Mental health care costs	1196	332	865**	(591, 1138)	1381**	(1173, 1588)
Mental health depression costs	100	221	120*	(14, 227)	481**	(642,334)
All medication costs	1482	1148	335*	(78, 591)	473**	(361, 585)
Antidepressant costs	285	144	141**	(72, 209)	199**	(147, 251)
Total inpatient costs	1561	1539	22	(-1145, 1188)	-3295	(-19835,13246)
Total costs	7300	5860	1440	(-110, 2990)	2161**	(1671, 2651)

Note. [†] T-tests were used to determine statistical significance. [‡]Data are analyzed using a one-part GLM model log link with gamma distribution and adjusted for population weights, probability of enrollment, clinic clustering and adjusted for age, male, white, college+ education, unemployment, on disability, retired, marital status, living alone, SIC, depression score, alcohol use (Audit_C), total social support, non-VA health insurance, effort to schedule appointment, effort to go to appointment. *p<0.05 **p≤0.001

V. DISCUSSION

This study examined the association between PTSD symptoms and health care utilization and costs in a sample of VA depressed patients. Total outpatient utilization was higher for PTSD+ depressed patients compared to PTSD− patients. This was mainly due to much higher mental health care use in PTSD+ patients. Health care costs were correspondingly higher for PTSD+ depressed patients – on average $1380 higher mental health costs, or about 22% of overall health care costs across both PTSD groups.

Our utilization and cost findings are generally consistent with previous studies indicating that PTSD contributes to increased utilization and costs of health care services [40, 76, 81]. This study found that higher utilization and costs were independent of depression severity. Unlike previous studies, we did not find higher utilization related to physical problems among PTSD+ patients; differences were concentrated in mental health utilization. One possible reason for this finding is that the PTSD− depressed patients were possibly sicker and had other medical conditions that were not adjusted for by SIC compared to our PTSD+ patients. SIC measured only a few serious chronic illnesses, such as cancer, heart attack, chronic lung diseases and diabetes, but does not measure many other physical problems such as gastric conditions or manifestations of somatization. Our results are consistent with patterns of increased outpatient visits for emotional health found by Campbell 2007 using self-report WAVES data. Unlike the Dobie et al study among women veterans [76], we did not analyze medical inpatient hospitalizations in great detail and did not find a significant difference in number of inpatient admissions.

Our findings suggest that PTSD+ depressed patients have higher primary care visits for depression than PTSD− patients after adjustment. While effective depression treatment in primary care has been demonstrated with collaborative care approaches, effective treatment for PTSD in primary care is not well-established. Those with PTSD and depression symptoms may

respond to care for depression symptoms or may benefit from a "stepped care" approach that incorporates PTSD−specialized mental health care or psychotherapy. A mental health care manager in a collaborative care treatment model could support and encourage PTSD+ patients to adhere to treatment plans and assist with resolving treatment problems. Future research should evaluate "stepped care" and collaborative care approaches to treating depression and comorbid PTSD.

We found several differences between adjusted and unadjusted utilization and costs results (data not shown). After adjusting for depression severity which is a significant confounder, the utilization rate ratio for primary care depression visits comparing PTSD+ and PTSD− patients increased and became statistically significant. Mental health depression visits became non-significant after adjustment due to the effect of white race being negatively associated with mental health depression visits. After adjusting for depression severity, total primary care costs became significantly higher in PTSD+ depressed patients. Also, primary care depression care costs became significantly higher for PTSD+ depressed patients than for PTSD− depressed patients after adjusting for white race and depression severity. After we adjusted for white race and marital status, total inpatient and outpatient costs were shown to be higher in PTSD+ compared to PTSD− depressed patients.

Our study has several limitations. It is a cross-sectional study so we were not able to investigate causal relationships between PTSD, depression and utilization. Also, our study participants are mainly male, white and elderly. PTSD trauma differs between women and men. In male veterans, the most common precipitant of PTSD is combat trauma; whereas in women, a history of sexual assault and rape are the main traumas [88, 89]. However, our PTSD screening tool and survey did not ask about exposure to combat or other trauma, so we were unable to determine which traumas led to PTSD. In addition, our study did not explore visits for specific physical or

medical illnesses in detail. Finally, our study used administrative data for costs and utilization which may have more errors and omissions than data collected specifically for research purposes.

VI. CONCLUSION

Veterans with depression who screen PTSD+ have higher utilization and costs of total outpatient services, mental health services, and higher proportion of patients using antidepressants than PTSD− depressed patients. Current rates of PTSD among service members from Iraq are reported around 9.8-12.9% currently [90, 91] and are expected to rise. As these service members return to the U.S. and to civilian life, VA and non-VA clinical practices are likely to see increases in outpatient utilization and costs for mental health care services. Military health insurers, VA and other health care systems, treating war veterans can use this information to plan for mental health needs of returning Veterans.

Chapter Three: Effectiveness and Cost-Effectiveness of Collaborative Depression Care in Veterans Screening Positive for PTSD in Primary Care

I. CHAPTER SUMMARY

Objective: To evaluate the effectiveness and cost-effectiveness of collaborative care depression treatment for primary care patients who screen positive for post-traumatic stress disorder symptoms (PTSD+).

Methods: Veterans' Affairs primary care patients with current depression were randomly assigned to collaborative care or enhanced usual care by provider group. Under collaborative care, a mental health team developed an individualized treatment plan for primary care providers, a social worker telephoned patients to enhance adherence, and suggested treatment modifications. A screening tool for primary care (PC-PTSD) was used to identify PTSD+ patients. Depression and disability outcomes were measured at three and nine months by telephone interview. Cost-effectiveness ratios and health care costs were assessed.

Results: Depressed PTSD+ patients in collaborative care showed a trend toward improvement in Hopkins Symptom Checklist-20 (SCL-20) depression score, from 3 months (-0.13, p=.19) to a greater reduction at 9 months (-0.17, p=.08) compared to usual care. Measures of disability did not show significant improvement. For collaborative care PTSD+ patients, the nine months total depression treatment costs averaged $266 more than the usual care cost (95%CI $17, $512) and collaborative care resulted in an additional 22.6 depression-free days (95%CI 2, 46) compared to usual care. The incremental cost-effectiveness ratio for PTSD+ patients was $21 per depression-free day (95%CI -$2, $61).

Conclusions: In veterans with depression and PTSD, collaborative care may improve depression symptoms and functioning. Collaborative care was associated with more depression-free days and

increased treatment costs. Further research is needed to confirm collaborative care effectiveness in depressed PTSD+ patients.

II. INTRODUCTION

Depression is increasing in prevalence and is now projected to be the second leading cause of disability worldwide by 2020 [92]. Among veterans, major depression is the second most prevalent medical condition and affects approximately 32% of outpatients.[13, 93] Many individuals with depression also have posttraumatic stress disorder (PTSD). In veterans with major depression, 36%-52% have PTSD [13, 56, 93]. The prevalence of a positive PTSD screen (PTSD+) was 9.8%-12.9% for warriors returning from Iraq [90, 91]. Patients with comorbid depression and PTSD are more severely depressed, more functionally impaired, have a more complicated and persistent history of mental illness,[57, 58] and have higher rates of suicidal behavior [59] than patients with depression alone or PTSD alone. Depression and PTSD are also associated with high medical care utilization and costs in both general and veteran populations[15, 39, 61, 79], and lower worker productivity [3, 4].

Depression treatment commonly occurs in primary care, [9, 19] where depression [49-51] and PTSD are reported to be under-detected and under-treated [3, 10, 11]. Collaborative care was shown to be an effective treatment for depression in primary care settings. Collaborative care depression treatment is based on a multilevel chronic illness model wherein multidisciplinary mental health care teams assist primary care providers deliver evidence-based treatment. Several studies report collaborative or multilevel interventions successfully improved the process and outcomes of depression care [19, 68] and led to improvements in social/role functioning for depressed primary care patients.[94] Studies also report collaborative-care to be cost-effective; leading to moderate

increases in days free of depression, improved worker productivity [5, 95] and moderate increases in treatment costs.[29-31, 70, 73, 74]

By contrast, there are no proven effective treatments for PTSD in primary care. PTSD is primarily treated in mental health specialty care with cognitive-based psychotherapy[96] and serotonergic medications [97, 98]. It is not known whether the collaborative care strategies effective for depression alone would also be effective for veterans with depression and PTSD. The purpose of this analysis is to determine if collaborative care treatment will decrease depression symptoms and reduce disability for PTSD+ depressed patients. In addition, this study will assess the cost-effectiveness of collaborative care versus usual care for the PTSD+ patients.

III. METHODS

A. Study Site and Participants

This study uses data from a randomized trial of collaborative care conducted in the General Internal Medicine Clinic of the Seattle Veterans Affairs Medical Center (VAMC) from January 1998 to March 1999 [26]. Of the four primary care provider groups at the Seattle VAMC, two were randomly assigned to collaborative care intervention, and two were assigned to usual care. Patients were interviewed in person or by telephone to assess depression and mental health history. Patients were eligible if they met the DSM-IV criteria for a current major depressive episode, dysthymia, or both. Patients under mental health specialty treatment were excluded. Clinical outcomes were assessed by telephone interviews at three and at nine months.[26] Approval was obtained from the University of Washington Institutional Review Board.

The interview instrument included a PTSD screen with one question about experiencing a traumatic event and three questions on PTSD symptoms: (1) "In the past month, have you felt distant or cut off from other people?", (2) "In the past month, have you been "super alert,"

watchful or "on guard"?, and (3) "During the past month, have you been bothered by repeated, disturbing memories, thoughts, dreams, or images of one or more stressful events that you have experienced?" This PTSD screen was recommended by 1995 VA Depression Guidelines[99]. We defined a PTSD+ screen as at least two PTSD symptoms and at least one traumatic event.

B. Description of Intervention

Primary care providers in both intervention and control groups received three hours of education about depression diagnosis, treatment and clinic resources. In the control group (usual care model), a primary care provider was responsible for initiating treatment with consultation from or referral to mental health specialists as needed. Consulting psychiatric residents were located in the same clinic as primary care providers. The collaborative care intervention was multifaceted [26] including diagnosis and treatment, patient education, patient support and progress evaluation based on a chronic illness model to deliver evidence-based treatment [100]. The collaborative care multidisciplinary team included a clinical psychologist, a psychiatrist, a social worker, and a psychology technician.

The collaborative care team met weekly to develop treatment plans and to conduct six-week and twelve-week progress evaluations. The team communicated with primary care providers using electronic progress notes and tracking pharmacy records. Treatment options included: (1) antidepressant medications, (2) cognitive-behavioral group therapy, (3) referral to mental health specialty care, or (4) appointments with the team psychologist or psychiatrist. No limits on specialty care visits were imposed. In addition, patients were mailed a videotape and workbook with cognitive behavioral therapy exercises to increase positive thoughts and activities. To evaluate progress and provide support to patients, a social worker telephoned each patient regularly to encourage adherence, address treatment barriers and assess response to the intervention.

C. Outcome Measures

Computer-assisted telephone interviews were conducted at baseline (within one week of enrollment), 3 months, and 9 months to assess treatment outcomes and functioning. Depression severity was measured using the Hopkins Symptoms Checklist (SCL-20) depression scale [101]. The Sheehan Disability Scale was used to measure how reduced health status interferes with work and school, family life and social life [102]. This scale has been previously used in trials of depression and panic disorder [94].

Depression-free days, our measure of cost-effectiveness, were calculated based on the method developed by Lave et al, [31] and adapted by other studies [32, 74]. SCL depression scores from baseline and 3- and 9-month assessments were used to calculate the number of depression-free days during the nine-month follow-up period.

Costs of care were estimated by the VA's cost accounting system, Cost Distribution Report, which uses an average cost-accounting method. This system provides an average cost per visit for a particular clinic. The cost estimates include direct and indirect costs adjusted to year 2000 dollars using the medical component of the consumer price index. Collaborative care intervention costs that were not included in the VA cost and utilization databases, such as team meetings and patient phone calls, were estimated by sampling staff activity records and computing average cost by using actual input costs, such as labor, fringe benefits, overhead costs, and the event duration.

Based on previous analysis by Liu et al [32], costs of health services were categorized into 3 groups: (1) *Depression-related treatment costs* included depression-related primary care costs, mental health specialty visit, antidepressant prescriptions and collaborative care intervention costs. Depression-related primary care costs were defined as costs from visits with a primary care clinic that included a depression diagnosis. A primary care clinic was defined as a general

medicine, primary care, women's, or geriatric clinic. Depression diagnosis was defined as ICD9 codes: 296.2x, 296.3x, 298.0, 300.4, 309.1, and 311. (2) *Total outpatient costs* included all encounters with medical and ancillary providers that included depression and non-depression-related costs. (3) *Total medical costs* included inpatient and outpatient health services costs.

D. Data Analysis

Descriptive analyses comparing differences in patient characteristics between PTSD groups at baseline were conducted using t-tests for continuous variables and Pearson chi-squared tests for categorical variables. T-tests were also used to assess the unadjusted differences in change scores for the SCL depression and Sheehan disability scores, for both 3- and 9-month follow-up intervals. Linear regression analysis of covariance (ANCOVA) was used to adjust differences in SCL and Sheehan change scores for a variety of baseline characteristics, including demographic factors (age, gender, race, marital status, education level) and confounding risk factors for depression including antidepressant use in the past year (proxy for previous depression treatment), baseline depression score, medical comorbidity measured by Chronic Disease Score (CDS),[103, 104] and social isolation (living alone). Adjusted analyses were done in a single regression, which included a PTSD x treatment interaction term. Statistical analyses used STATA 9.2 (College Station, Texas, 2005).

For the cost-effectiveness analysis, depression-free days were modeled using regressions that adjusted for provider clustering. Outpatient costs and depression costs were compared using a one-part generalized linear model gamma distribution with log-link.[105] Confidence intervals for cost, effectiveness, and cost-effectiveness were estimated using bootstrap methods with 1000 replications. All cost-effectiveness models were adjusted for the same covariates as the outcomes analysis mentioned above and for costs in the previous year.

Previous studies reported that depression lowers the value of a life-year by 0.2-0.4 (i.e. the difference between a day of depression and a depression-free day ranges from 0.2 to 0.4 of a

quality-adjusted day).[29-31, 70, 74] To determine the range of depression treatment cost per quality-adjusted life year (QALY), the incremental cost-effectiveness ratio for depression treatment costs was divided by 0.2 for the upper limit and 0.4 for the lower limit.

IV. RESULTS

A. Patient Characteristics

The study enrolled 354 patients: 168 in collaborative care and 186 in usual care. Follow-up interviews at 9 months had a response rate of 87 percent for the intervention group and 88 percent for the control group.[26] For this analysis, we excluded 5 patients who reported taking lithium, tegretol or depakote and reported that a doctor told them they were bipolar. Also excluded were: 7 patients who did not complete the PTSD screening tool, 2 patients with missing education level, 4 patients who died within 12 months after baseline, and 42 dropped patients who missed 3 month or 9 month depression scores. The final sample size was 294 depressed patients including 161 PTSD+ and 133 PTSD− patients.

Baseline characteristics of the study participants were not significantly different between collaborative care and usual care groups.[26, 32] Patients that dropped out at 3 or 9 months were not significantly different than those that remained in the study sample. There were significant differences between depressed PTSD+ patients and PTSD-negative (PTSD−) patients at baseline (Table 7). PTSD+ depressed patients were generally younger, non-white, and less likely to be married than PTSD− patients. PTSD− patients were less likely to graduate high school than PTSD+ patients and had a higher mean number of chronic conditions (CDS 4.0 vs. 3.2; $p=0.03$). Depressed PTSD+ patients were more likely to have greater depression severity (SCL score 2.1 vs. 1.6, $p<0.001$), lower mental health functioning (SF-36 Mental Component Score 31.49 vs.

38.13, p<0.001), and higher disability (Sheehan score 5.89 vs. 5.03, p=0.002), than depressed PTSD− patients.

Table 7: Baseline characteristics of depressed veterans by PTSD status (n=294)

Demographics	Depression and PTSD-positive (n=161)	Depression and PTSD-negative (n=133)	P[a]
Age (mean SD years)	54.3 (13.3)	61.8 (13.3)	<0.001
% Male	95.0	97.0	0.398
% White	73.3	88.7	0.001
% Married	37.3	52.6	0.008
% Living alone	32.9	24.1	0.095
Education			<0.001
% < High school	36.6	47.4	
%Graduated high school/GED	49.7	27.8	
% Some college or more	13.7	24.8	
% Antidepressant medication use in past year	53.4	50.4	0.604
Mean Chronic Disease Score (SD)[b]	3.24 (2.95)	4.02 (3.20)	0.032
Mean SCL-20 (SD) depression score[c]	2.12 (0.59)	1.57 (0.64)	<0.001
Mean SF-36 Physical Component score (SD)[d]	32.89 (11.80)	33.69 (11.30)	0.553
Mean SF-36 Mental Component score (SD)[d]	31.49 (10.10)	38.13 (12.17)	<0.001
Mean Sheehan Disability Scale score (SD)[e]	5.89 (2.38)	5.03 (2.41)	0.002

Note: [a] Significance tests include chi-squared analyses for categorical data and t-tests for continuous data. [b] Chronic Disease Score possible scores range from 0 to 29 with higher score indicating more comorbid illnesses. [c] SCL-20 possible scores range 0 to 4, with higher score indicating more severe depression. [d] SF-36 possible scores range 0 to 100, with higher score indicating greater functioning. [e] Sheehan Disability Scale higher score indicates greater disability. S.D. = standard deviation

B. Collaborative Care Effect on Depression Outcomes by PTSD Status

Depressed PTSD+ patients who enrolled in collaborative care did not show a significantly greater reduction in depression severity than enhanced usual care patients at 3 and 9 months (Table 8). Between baseline and 3 months, SCL depression scores decreased an average of 0.34 for collaborative care patients, compared to 0.18 in usual care; and between baseline and 9 months, an average of 0.46 for collaborative care, compared to 0.25 for usual care, in unadjusted analyses. At 3 months, the multivariate regression model found a similar mean

reduction of 0.13 in SCL score of collaborative care patients compared to usual care patients, but this was not statistically significant (p=0.19). Also at 9 months, PTSD+ depressed patients under collaborative care had SCL depression scores on average 0.17 lower than usual care patients, which approached statistical significance (p=0.08). For PTSD− depressed patients, the multivariate regression model showed that collaborative care had a significant treatment effect at 3 months with a reduction in SCL score of 0.23 (95% CI -0.44 to -0.01; p=0.04) compared to usual care patients, but the treatment effect was not evident at 9 months.

Table 8: Mean Symptom Check List depression score (SCL-20) difference between collaborative care and usual care at 3 and 9 months (n=294)

(range 0-4)	Unadjusted			Adjusted[a]		
	Collab. care (n=136) Mean change (SD)	Usual care (n=158) Mean change (SD)	Mean difference between collab. care & usual care (95%CI)	Difference between collab. care & usual care (95% CI)	Std error	P
PTSD+						
Baseline to 3 mos	-0.34 (0.65)	-0.18(0.63)	-0.16(-0.36, 0.04)	-0.13(-0.34,0.07)	0.10	0.192
Baseline to 9 mos	-0.46 (0.62)	-0.25(0.83)	-0.21(-0.44, 0.02)	-0.17(-0.37,0.02)	0.10	0.083
PTSD−						
Baseline to 3 mos	-0.35 (0.64)	-0.15 (0.66)	-0.20(-0.43, 0.02)	-0.23(-0.44,-0.01)	0.11	0.042
Baseline to 9 mos	-0.36 (0.64)	-0.26 (0.66)	-0.09(-0.32, 0.13)	-0.09(-0.36,0.13)	0.12	0.338

Note: [a]Linear regression adjusted for age, sex, race, education, marital status, living situation, baseline chronic disease score, SCL score and previous year's antidepressant use. (Full treatment effect or difference between collaborative care and usual care groups for PTSD+ patients =Treatment + Treatment x ptsd) mos − months; S.D.− Standard deviation; C.I. − Confidence interval; Mean change − mean change between baseline and follow-up.

C. Collaborative Care Effect on Functional Status

Table 9 shows depressed PTSD+ patients in collaborative care had an average decrease in the Sheehan Disability score between baseline and 3 months of -0.44 (95% CI -1.18 to 0.30) compared to usual care patients after adjustment. ANCOVA regression adjusted analyses found that although collaborative care had a greater decrease in disability compared to usual care at 9

months (-0.61; 95% CI -1.37 to 0.15) than at 3 months, the reduction in disability scores was not statistically significant. For depressed PTSD− patients, adjusted results found collaborative care was associated with a significant decrease in disability of 0.85 at 3 months (95% CI -1.58 to -0.13; p=0.02), but not at 9 months.

Table 9: Mean Sheehan Disability Scale difference between collaborative care and usual care at 3 and 9 months (n= 280)

(range 0 to 30)	Unadjusted			Adjusted[a]		
	Collab. care Mean change (SD)	Usual care Mean change (SD)	Mean difference between collab. care & usual care (95%CI)	Difference between collab. care & usual care (95% CI)	Std Error	P
PTSD+						
Baseline to 3 mos	-0.31(2.65)	0.27(2.51)	-0.58 (-1.41, 0.26)	-0.44(-1.18,0.30)	0.37	0.24
Baseline to 9 mos	-0.49(2.57)	0.34(2.74)	-0.83 (-1.68,0.03)	-0.61(-1.37,0.15)	0.38	0.12
PTSD−						
Baseline to 3 mos	-1.08(2.07)	-0.10(2.22)	-0.98 (-1.73,-0.23)*	-0.85(-1.58,-0.13)	0.36	0.02
Baseline to 9 mos	-0.74(2.65)	-0.35(2.05)	-0.36 (-1.23, 0.45)	-0.38(-1.10,0.33)	0.36	0.28

Note: * p<.05 [a] Mixed effects linear regression adjusted for age, sex, race, education, marital status, living situation, baseline Chronic Disease Score, Sheehan disability score and previous year's antidepressant use. (Difference between collaborative care and usual care groups =Treatment + treatment x ptsd) mos – months; S.D. – Standard deviation; C.I. – confidence interval; Mean change – mean change between baseline and follow-up.

D. Incremental Cost and Cost-Effectiveness of Collaborative Care

Table 10 shows the unadjusted cost of care per patient for the nine-month follow-up period. None of the unadjusted differences in costs between the collaborative care and usual care groups were statistically significant, for either PTSD+ or PTSD− patients. There was a trend toward higher outpatient costs and lower mental health specialty costs in both groups; for example, for PTSD+ depressed patients, collaborative care total outpatient costs were an estimated mean $788 greater than usual care.

Table 10: Unadjusted cost of care per patient after baseline comparing depressed veterans receiving collaborative care or usual care by PTSD screen status (n=294)

	Depression and PTSD positive			Depression and PTSD negative		
	Collaborative care (N=77)	Usual care (N=84)	Mean Diff.	Collaborative care (N=59)	Usual care (N=74)	Mean Diff.
Type of cost ($)	Mean (95%CI)	Mean (95%CI)	Mean(95%CI)	Mean (95%CI)	Mean (95%CI)	Mean(95%CI)
Total outpatient costs	3899(3287,4752)	3111(2619,3635)	788(-99,1675)	3578 (2920,4321)	3209(2660,3849)	369 (-519,1256)
Total depression treatment costs	968 (833,1110)	793 (581,1007)	175(-86, 437)	872 (716,1027)	653 (460,876)	219(-42, 478)
Primary care visits	424 (334,521)	394 (265,548)	30(-138,198)	367 (265,486)	340 (197,503)	27(-164, 219)
Mental health specialty	100 (47,168)	203 (99,336)	-103(-237, 30)	66 (33,105)	121 (67,184)	-55(-126, 17)
Antidepressant medications	266 (212,323)	196 (143,252)	70 (-8,149)	264 (198,334)	199 (136,262)	65(-28,158)
Intervention program	178 (160,199)	0		175 (156,197)	0	
Social work calls	49 (41,59)	0		52 (43,61)	0	
Team treatment meetings	129 (114,144)	0		123 (107,138)	0	
Total health services costs	5718(4186,7576)	4971(3426,6707)	747(-1716,3209)	6513(4186,9660)	8332(4458,13124)	-1819(-6826,3189)

Note: ** p<0.01 * p<.05; C.I. – confidence interval; Mean Diff. – mean difference between collaborative care and usual care.

The results for the adjusted incremental cost and cost-effectiveness of collaborative care intervention are presented in Table 11. For depressed PTSD+ patients, the adjusted incremental total depression treatment costs for collaborative care was $266 (95%CI $17 to $512) more than usual care. Total outpatient costs for collaborative care were on average $801 (95%CI $102 to $1542) more than usual care. Adjusted analyses showed no difference in incremental total costs for PTSD+ and PTSD− patients. Compared to PTSD+ patients incremental depression treatment costs of collaborative care for depressed PTSD− patients were higher on average $ 445 (95%CI 129 to 796) and lower for total outpatient costs $74 (95%CI -$799 to 921) (see Table 11).

Table 11: Adjusted Incremental Cost and Cost-Effectiveness of a Collaborative Care Intervention for Veterans with Depression[a]

	Depression and PTSD positive		Depression and PTSD negative	
	Incremental cost ($)	Cost per additional depression-free day ($)	Incremental cost ($)	Cost per additional depression-free day ($)
	Mean (95% CI)	Mean (95% CI)	Mean (95% CI)	Mean (95% CI)
Depression treatment costs	266 (17, 512)	21 (-2, 61)	445 (129, 796)	55 (-293, 393)
Total outpatient costs	801 (102, 1542)	19 (-45, 214)	74 (-799, 921)	18 (-48, 179)
Total costs	630 (-1579,2595)	11 (-188,297)	-1670[b] (-5509,2181)	-31[b] (-1960,2669)

[a] Confidence intervals were estimated by bootstrapping 1000 replications.
[b] Negative values actually indicate no difference between collaborative care and usual care due to large 95% CIs.

For depressed PTSD+ patients, collaborative care resulted in an additional 21.4 days free from depression (95%CI 2 to 45) compared to usual care over nine months (data not shown). By comparison, there was not a statistically significant difference in depression free days between collaborative and usual care among PTSD− patients.

Table 11 shows for depressed PTSD+ patients, the incremental cost-effectiveness ratio for total depression treatment costs was $21 per depression-free day (95%CI $-2, $61). For total outpatient costs, the additional cost per depression-free day was approximately $19 (95% CI -$45, $214). Negative total cost-effectiveness ratios indicate no difference between collaborative care and usual care. We could not conclude that collaborative care led to cost-savings, based on the cost-effectiveness ratios for total costs and total outpatient costs because the wide 95% confidence intervals included zero (Table 11) and reflect the uncertainty in incremental cost and incremental effectiveness estimates. The depression treatment cost per QALY is estimated at $29,930-$59,860 for depressed PTSD+ patients and $30,386 - $60,773 for PTSD− patients.

V. DISCUSSION

This study, using data from a randomized trial of collaborative care for depression at the Seattle VAMC, found collaborative care trended toward a positive effect on depression and disability outcomes but did not reach statistical significance for the subgroup of depressed patients who screened positive for PTSD. When depressed PTSD+ patients received collaborative care treatment, they showed a non-significant reduction in depression symptoms and disability compared to those in usual care. The cost-effectiveness analysis found a moderate increase in days free of depression over the nine-month study period comparing collaborative care to usual care participants among depressed PTSD+ patients but were not significant for PTSD− patients.

Our study findings comparing PTSD+ to PTSD− depressed patients differed slightly from previous studies on the overall depressed patient population. In the previous paper by Hedrick et al reporting on the overall study findings, collaborative care led to significant

improvements in depression and disability from baseline to 3 months, but not at 9 months. No subanalyses were conducted examining whether the results varied by PTSD status [26]. A cost-effectiveness paper from the overall study [32], found a nonsignificant difference of 14.6 depression-free days between the collaborative care and usual care groups, less than the 22.6 depression-free days (95% CI 2, 45) difference for PTSD+ patients in this analysis.

Patients with depression and comorbid PTSD were also studied by Hegel et al. who compared the effect of collaborative care versus usual care among comorbid PTSD depressed older staff-model HMO patients. Hegel et al. found a significant improvement in SCL depression score for collaborative care patients versus usual care patients at 12 months, but no significant improvement at 3 or 6 months in comorbid PTSD patients [72]. Compared to Hegel et al., patients in our study were slightly younger, primarily male, while the PTSD− patients were older and had more comorbid medical illnesses.

Unadjusted results found that total outpatient costs, depression treatment, mental health and total health costs were not significantly different between collaborative care and usual care for PTSD+ and PTSD− patients but there was a trend toward higher outpatient costs and lower mental health costs among collaborative care patients. After adjustment, on average, we estimated that total outpatient costs for collaborative care among depressed PTSD+ patients cost an additional $801 (95%CI $102, $1542) for the 9-month intervention compared to an additional $74 (95%CI -$799, $921) for PTSD− patients. These findings are consistent with other studies which show that increased funds for collaborative care are required to achieve improved outcomes for patients with major depression [29, 30, 32, 70, 73, 74]. In order to compare the cost-effectiveness of these findings to other interventions, a common measure of effectiveness must be used, such as cost per quality-adjusted life year (QALY). In this study, the cost per QALY for depressed PTSD+ patients is $29,930-$59,860 which is comparable to

the range of cost per QALY ratios found in previous studies ranging between $9,051 and $49,500 and suggests that collaborative care is comparable to other medical treatments and services [29-31, 70, 74].

There are several study limitations. First, the PTSD screening questions, which were recommended by VA Depression Guidelines, have not been validated against standard semi-structured PTSD diagnostic interviews. Second, there is a limited effective sample size for this analysis given the interaction terms that needed to be tested so power may not have been sufficient to detect relatively small changes in outcomes. Third, generalizability may be limited in this single-site VA study where study patients were older, primarily male, less well-educated and had more comorbidities including comorbid psychiatric illness than the general primary care population. The follow-up multisite implementation study, "Well-being Among Veterans Enhancement Study" (WAVES), is ongoing and will address the limitations of this study. Fourth, this study does not include cost and utilization from non-VA providers because our focus was the VA payer perspective.

VI. CONCLUSIONS

Despite the failure to reach conventional levels of statistical significance for the main study findings, our results suggest that collaborative care may improve patient depression-related outcomes with a moderate increase in costs for those who screen positive for PTSD symptoms. Further trials with larger samples are needed to confirm whether collaborative care is an effective treatment strategy for depressed patients with PTSD.

Chapter Four: The Impact of Depression Care Management on Attitudes Toward Depression Treatment Among Depressed Patients with PTSD

I. CHAPTER SUMMARY

Background: Changing attitudes and beliefs toward depression treatment is a key part of the collaborative care model. Depression care managers (DCM) work to increase patients' knowledge about depression and break down cognitive barriers that may prevent patients from seeking treatment for depression.

Purpose: This study examines whether DCM assessment led to increased depression knowledge and more positive attitudes towards depression treatment compared to non-assessed patients in a group of primary care elderly veterans who screened positive for post-traumatic stress disorder (PTSD).

Methods: A pre-post comparison group design was used to assess the impact of DCM assessment on primary care patients with PTSD participating in a multi-site trial of collaborative care at the Veteran's Administration. Attitudes and knowledge related to depression treatment were assessed using a survey conducted at baseline and 7 months. The DCM assessment was a 45 minute phone intervention monitoring patient symptoms and problem-solving around treatment barriers.

Results: We found no significant differences in changes in patient knowledge and attitudes about depression treatment between assessed and non-assessed depressed PTSD patients.

Conclusions: In our study, DCM assessment, a crucial component of the collaborative care intervention, did not lead to more positive attitudes towards depression treatment.

II. INTRODUCTION

Depression is projected to become the second leading cause of disability worldwide by 2020 [92]. Patients with comorbid PTSD and depression are more severely depressed, more impaired and have higher rates of suicidal behavior than patients with depression or PTSD alone. Despite evidence that antidepressants and psychotherapy are effective treatments, depression and PTSD are often undetected and inadequately treated in older adults [11, 49, 51].

Understanding treatment beliefs and attitudes is important to reducing barriers to care and improving access to effective depression and PTSD treatment. Several negative cognitive beliefs and attitudes can be potential barriers to seeking depression treatment for patients with depression and PTSD. First is self-stigma which is the internalization of how the general public portrays people with mental illness and the belief in that negative, prejudiced or stereotyped portrayal [106, 107]. Second is the fear of social stigma, the fear of social exclusion because of PTSD symptoms [107]. Social stigma may also prevent veterans with post-traumatic stress disorder (PTSD) or depression from seeking care for emotional problems [91, 107]. Third is patient treatment preference which appears to be related to entering depression treatment [108]. Patients who received their preferred depression treatment improve more quickly than those who do not receive their preferred treatment [109]. For example, patient treatment preferences for counseling or psychotherapy are associated with greater reduction in depression symptoms for mild to moderate depression [110]. Beliefs about treatment are important predictors to understanding treatment preferences [111]. Fourth, beliefs about antidepressant medications are important contributors to depression treatment initiation, acceptance, and adherence [65-67]. Fifth is the perceived need for treatment that is associated with receiving and readiness for mental health treatment [112]. Sixth is the belief that one will get better with treatment. A final cognitive barrier is the unwillingness of the patient to accept a diagnosis of depression [113].

Depression care managers working within the collaborative care model of depression treatment can assist in modifying these beliefs. Over 20 randomized control trials in a wide range of patient populations have shown that collaborative care depression treatment is effective in improving depression and functional status [114], but these studies have not looked in detail at the pathways by which collaborative care achieves these positive results. In particular, are observed improvements in depression symptoms associated with changes in knowledge and attitudes about depression treatment? The purpose of this paper is to examine whether a key component of collaborative care - a depression care manager (DCM) assessment - leads to increased depression knowledge, and more positive attitudes and beliefs towards depression treatment compared to non-assessed patients in a group of primary care elderly veterans who screen positive for PTSD.

III. METHODS

This quasi-experimental study is part of a larger clinic-randomized intervention study evaluating collaborative care for depression [56]. A pre-post comparison group design was used to evaluate the depression attitudes and beliefs of patients assessed by DCMs and those who are not assessed by DCMs.

Changing knowledge, attitudes and beliefs toward depression treatment is a key part of the Collaborative Care Model [64]. According to collaborative care theory which is based on Wagner's chronic illness model, depression care managers (DCM) work to increase patients' knowledge about depression and depression treatment. DCMs also help to break down cognitive barriers and to solve problems to encourage patients to seek treatment for depression (see Figure 3). DCMs assess patients, monitor patients, and provide encouragement for behavioral/cognitive changes, such as beliefs towards treatment, and encourage adherence to

treatment, such as medication compliance. They also recommend modifications to treatment plans as needed.

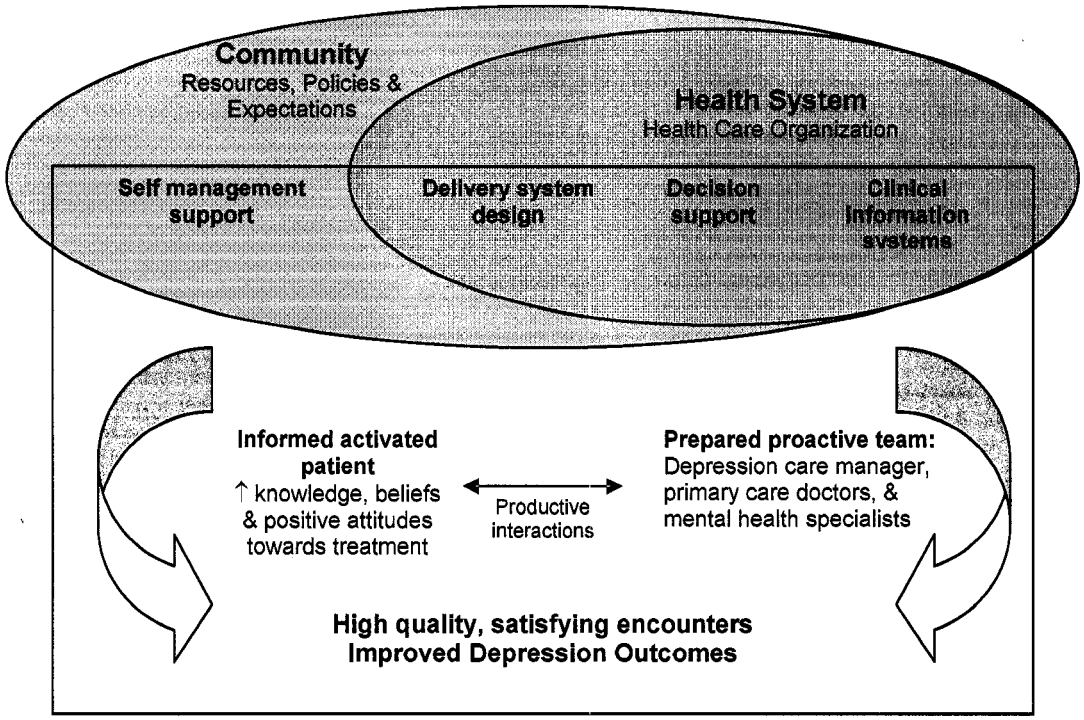

Figure 3: Wagner Chronic Care Model adapted to Collaborative Care Depression Treatment [17, 71]

A. Setting and Participants

Study participants were from 10 Veterans Affairs (VA) primary care clinics across five states and received care between June, 2002 and June, 2003. The parent study's sampling frame was 28,474 patients. See Appendix II for the patient flow chart diagramming recruitment and retention in this study. Parent study eligibility required participants to have an upcoming appointment and to have attended a study clinic within the previous 12 months. A total of 10,929 patients (38% of sampling frame) were screened for depression by the Patient Health Questionnaire 9-item measure (PHQ-9) over the telephone; 9,539 patients had a negative screen; 76 refused a full screen and one patient was acutely suicidal [56]. Patients with

a positive screen of PHQ-9 $\geq$ 10 met the criteria for depression. Out of the 1,313 eligible for the study, 523 refused enrollment, 29 were acutely suicidal and 761 patients participated in the baseline parent study. In the parent study, three clinics were randomized to provide usual depression care (n=375 patients) and seven clinics (n=386 patients) were assigned to collaborative care depression treatment. In the current study, we restricted our sample to patients in the collaborative care group (treatment group) who remained in the sample at 6 month follow-up (n= 288; 75%) and who screened positive for PTSD (n=105). One patient with missing DCM-assessment status was dropped from the study sample. We screened patients for PTSD with the PC-PTSD screening tool [83]. Screening positive for current PTSD (PTSD+) was defined as having 3 out of 4 PTSD symptoms in the last 6 months on the Primary care-PTSD screen [83]. This current study sample included 104 PTSD screen positive depressed veterans assigned to collaborative care who were retained in the study after 7 months. Patient characteristics of those who dropped out were not significantly different from patients who remained in the study. The study sample consisted of 56 who were assessed by depression care managers and 48 who were not assessed, according to depression care manager reports.

B. Intervention - Depression Care Manager Assessment

The depression care managers were nurses trained in using a mental health collaborative care model. DCMs attempted to assess all subjects with contact information. They quit after five attempts if they could not reach a patient. When DCMs faced time limitations and had to triage patients, they focused their efforts on patients who were not yet in mental health specialty care and those already in mental health care were contacted later. The depression care manager assessment is a one-time 45-minute telephone interview in which the care manager assesses the depression severity of the patient, monitors symptoms, educates the

patient and assists the patient in problem-solving barriers to treatment. DCMs may also discuss coping and activation strategies with the depressed patient. DCMs encourage the patient to follow the treatment plan or may suggest modification if it's not working. The average exposure to DCMs was two phone contacts over 7 months. The follow-up contacts were shorter on average around 10-15 minutes. However, the main intervention exposure that we are evaluating is this one-time 45-minute initial DCM assessment.

C. Measures

The primary dependent survey variables from the Perceptions about Depression Scale measures attitudes, knowledge and beliefs about depression and depression treatment. It was shortened from the Partners in Care Depression Attitudes 12-item scale [19, 115]. This scale assessed agreement (strongly agree, agree, neither, disagree, strongly disagree) with 12 statements (see Table 12).

Table 12: Perceptions About Depression Scale

To what extent do you agree or disagree with each of the following statements: (strongly agree, agree, neither, disagree, strongly disagree)	
a. People who take antidepressant meds for depression should continue to take them for at least several months after they feel better	Knowledge
b. Biological or chemical changes in the brain contribute to depression.	Knowledge
c. If, at my next visit, your doctor told you to take meds for depression, I would do that.	Attitudes/ Intention to take antidepressants
d. Talking with a health professional can be a great help to a person with an upsetting emotional problem.	Attitudes
e. I would NOT want my employer to know I was getting professional help for an emotional problem.	Stigma
f. I feel that I need treatment for depression at this time.	Perceived Treatment Need
g. If my doctor told me I had depression, I would accept that.	Intention to Accept diagnosis
h. I think my emotional problems would get better with professional treatment.	Treatment expectation

Note: Scale items a, b, c, d, f, g, and h were analyzed as the 7- item scale. Item e was analyzed separately.

Several other covariates related to mental and physical health status were included in the analysis and these measures were administered over a computer-assisted telephone interview. Depression severity was assessed by the Patient Health Questionnaire, a 9-item measure (PHQ-9)[84]. Higher scores indicate more severe depression symptoms. The AUDIT-C screen was used to assess alcohol abuse [86]. A suicidal ideation measure was taken from the last item of the Patient Health Questionnaire 9-item (PHQ-9) depression scale. To screen for current anxiety symptoms, patients were asked "During the last 6 months, have you felt anxious much of the time?" To screen for panic attack symptoms, patients were asked "In the past 6 months, have you had a panic attack when you suddenly felt intense fear and discomfort?" Comorbid chronic medical illnesses were assessed by the Seattle Comorbidity Index (SIC).[85] The index includes the presence or absence of seven chronic illnesses, smoking status and age. The SIC summary score predicts hospitalization and mortality.

Antidepressant usage data were from the VA Pharmacy Benefits Management database. Antidepressant usage was defined as one or more prescription fills of psychiatric medications. Antidepressant medications below therapeutic daily dose levels were excluded. These therapeutic daily dose levels included: trazadone <300mg/day, amitriptyline <50mg/day and mirtazapine <45mg/day. Outpatient utilization data was extracted from the VA Outpatient Care File for the prior 12 months to enrollment. We ascertained number of mental health visits and mental health depression visits in the 12 months prior to WAVES enrollment. Finally, to assess patient satisfaction with emotional health care services, WAVES asked patients "How satisfied were you with the overall health care services available to you specifically for emotional problems in the past 6 months?" Satisfaction was rated on a five-point Likert scale ranging from very satisfied to very dissatisfied.

Additional variables in the analysis included baseline demographic information: age, gender, ethnicity, marital status, living situation, education and employment status were collected. Social support, general health and other measures are described in Campbell et. al., 2007 [56]. All these additional variables were collected by computer-assisted telephone interview.

D. Data Collection

Patients were evaluated at enrollment and 7 months after enrollment by the Well-being Veterans Enhancement Study (WAVES) survey, a 50 minute computer-assisted telephone interview that included questions about demographics, mental health, physical health, and health care satisfaction including the measures mentioned above except for the utilization measures. This computer-assisted telephone interview was conducted by an independently contracted survey research firm. Interviewers were blind to participants' treatment status. DCMs did not have access to these patient surveys.

E. Analysis

Patient characteristics were summarized by DCM assessment status, using t-tests for continuous variables and chi-square tests for categorical and binary variables. Since the shortened Perceptions About Depression scale has not been previously validated, we calculated the Cronbach's alpha for this scale to test for internal consistency reliability using the entire sample of WAVES patients who answered these questions at baseline or at 7 months follow-up. Analysis of the Depression Perceptions scale used t-tests for unadjusted analysis and ordinary least squares regression for adjusted analyses. Covariates in the adjusted analysis included age, white race, mental health visits in previous year, and baseline Seattle Comorbidity Index (SIC).

We examined each of the individual scale items, in addition to the overall scale. Individual scale items were categorized as "Agree" and "Disagree/neither" for the attitudinal statements and as "Satisfied" and "Neither/Dissatisfied" for the patient satisfaction variables. Logistic regression models with the same covariates as the overall scale regressions were used to check for potential confounding. All analyses used statistical procedures that accounted for weighting and clinic-level clustering. STATA 9.2 (College Station, Texas, 2005) was used for all analyses.

IV. RESULTS

A. Scale Diagnostics

A principal components analysis showed that the question on employer stigma was uncorrelated with the other scale items, so two versions of the scale were calculated. The 8-item version included all original scale items. The 7-item version excluded the employer stigma question. For the 8-item scale, the Cronbach's alpha at baseline was 0.72 and at 7 months was 0.75. For the 7-item scale that excluded the stigma item, the Cronbach's alpha at baseline was 0.77 and at 7 months was 0.79. The pre-post results were similar using the two versions of the scale so only the seven-item scale results are reported here.

B. Patient Characteristics

Table 13 compares characteristics of patients who were assessed by depression care managers (n=56) to those who were not assessed by DCMs (n=48). In this sample of older male veterans, a higher percentage of patients who were assessed by DCMs were white (88.4%) vs.72.3% non-white (p=0.019). Prior mental health utilization was higher among non-assessed patients: of patients not assessed by DCMs, 91.9% had been in mental health treatment compared to 56.8% of DCM-assessed patients, and 38% had mental health visits for depression in the previous year compared to 13% of DCM-assessed patients. Baseline

attitudes toward depression treatment as measured by the 7-item scale were significantly higher in the patients not assessed by DCMs (29.8 vs. 27.6; p=0.027), suggesting more positive attitudes toward depression treatment at baseline.

Table 13: Patient characteristics by Depression Care Manager exposure for depressed PTSD+ veterans

Characteristic	Total	DCM Assessed (n = 56)	Not Assessed (n = 48)	$p^{\ddagger}$
Demographics				
Age				0.067
<55	32.5	36.3	27.8	
55-64	47.3	34.6	62.9	
65+	20.3	29.1	9.3	
Male (%)	95.0	94.8	95.2	0.939
White (%)	79.5	72.3	88.4	**0.019**
Married (%)	60.7	60.0	61.6	0.921
Living alone (%)	35.2	38.0	31.7	0.639
Education (educ3) (%)				0.966
HS grad or less	38.1	38.0	38.3	
Some college or more	61.9	62.0	61.7	
Employment status(%)				0.471
Full-time or Part-time	16.2	12.8	20.3	
Unemployed	11.4	13.4	9.0	
On-disability	50.1	47.5	53.3	
Retired	22.3	26.3	17.4	
Health and Mental Health				
Poor Health (%)	42.6	42.6	42.7	0.998
Mean physical comorbidity: SIC (SD)	6.58(2.55)	6.92(5.02)	6.16(2.62)	0.230
Mean Alcohol Use: AUDIT-C (SD)	2.08(2.11)	2.12 (4.54)	2.03(5.62)	0.923
Mean social support (SD) *	3.4(1.8)	3.4(2.9)	3.4(2.1)	0.874
Mean depression severity: PHQ-9 (SD)	17.2(3.7)	17.0(4.6)	17.4(5.7)	0.569
Suicidal thoughts (%)	37.9	38.8	36.7	0.785
Anxiety (past 6 mos) (%)	85.8	86.6	84.8	0.838
Panic (past 6 mos) (%)	64.9	58.8	72.4	0.356
Prior antidepressant use (past 12 mos)	66.8	55.4	79.9	0.079
Prior mental health care (past 12 mos)	73.1	56.8	91.9	**0.010**
Prior mental health depression care	24.6	13.0	38.0	**0.027**
Perceptions of Depression Treatment	28.6	27.61	29.80	**0.027**
Satisfaction with emotional health services	60.0	58.5	61.7	0.696

Note: * Higher social support score indicates greater social support.

C. Depression Knowledge and Attitudes

Table 14 shows unadjusted results comparing pre/post changes in attitudes and beliefs related to depression treatment. In general, the results show no significant changes pre/post in either the DCM assessed or not assessed group, and no differences in the change scores between the two groups. For example, the overall Perceptions about Depression scale decreased slightly from pre to post in both groups (from 27.8 to 27.2 in the DCM-assessed group and from 29.8 to 29.6 in the non-assessed group). The relative change was -0.4 between the two groups and not statistically significant (p=0.49).

The results for the individual scale items were similar. Antidepressant knowledge appears to have increased from 63.5% at baseline to 82.1% with the antidepressant knowledge statement at 7 months among patients assessed by DCMs. While this increase may be clinically significant, this increase was not statistically significantly different from the increase in antidepressant knowledge among non-assessed patients, which increased from 65% to 73%. In the DCM-assessed patients, knowledge of biological chemical basis of depression appeared to decrease over 7 months while knowledge remained the same in patients who were not assessed by DCMs (not significant). A higher percentage of patients who were not assessed by DCMs perceived a need for treatment (89.6% at baseline and 87.3% at 7 months) compared to those who were assessed by DCMs (66.1% at baseline and 61.2% at 7 months). There was no significant difference in change in perceived treatment need over 7 months between DCM-assessed and non-assessed patients. Similarly, other post-pre changes in depression attitudes toward treatment were not significant. Differences between 7 months and baseline on the perception of employer stigma did not vary between DCM-assessed and non-assessed patients. Satisfaction with emotional health services appeared to increase slightly over time both among

DCM-assessed and non-assessed patients. There were no significant differences in the change in patient satisfaction for emotional health services over 7 months.

Multivariate regression results adjusted for age, white race, mental health visits in previous year, and baseline SIC. We did not find any statistically significant differences between changes in overall Perceptions about Depression or changes individual knowledge/attitudes towards depression treatment over 7 months. Also, no differences in patient satisfaction were found between DCM-assessed and non-assessed patients after adjustment for confounders.

Table 14: Change in depression attitudes (7-item), by Depression Care Manager Assessment Status

	DCM Assessed			Not Assessed			Difference in post-pre	
	Baseline Pre (A)	Post (B)	Post-Pre Diff. (C=B-A)	Baseline Pre (D)	Post (E)	Post-Pre Diff. (F=E-D)	b/w DCM Assessed & Not Assessed	*p*
Depression Perceptions Summary Scale† (Mean)	27.77	27.17	-0.60	29.75	29.60	-0.14	-0.45	0.487
Depression Perceptions Scale Items: † (% Agreement)								
a.Take antidepressants for at least several months after feeling better	63.5%	82. 1%	18.5%	65.8%	73.5%	7.8%	10.8%	0.248
b. Biological or chemical changes contribute to depression	82.1%	71.1%	-11.0%	89.9%	89.0%	-0.9%	-10.1%	0.450
c. Would take meds for depression	81.8%	82.8%	1.0%	86.8%	91.9%	5.1%	-4.1%	0.484
d. Talk therapy is helpful for emotional problems	90.4%	90.1%	-0.3%	89.4%	93.1%	3.7%	-4.0%	0.535
f. Need for treatment	66.1%	61.1%	-5.0%	89.6%	87.3%	-2.3%	-2.7%	0.988
g. Accept depression diagnosis	90.2%	89.9%	-0.3%	92.7%	98.2%	5.5%	-5.8%	0.268
h. Emotional problems would get better w/ professional treatment	68.4%	66.0%	-2.4%	77.4%	86.6%	9.2%	-11.6%	0.217
e. Do not want employer to know about getting help for emotional problem*	49.7%	50.3%	0.6%	47.8%	46.8%	-1.01%	1.6%	0.901
Satisfaction with emotional health services	58.5%	67.0%	8.4%	61.7%	68.9%	7.27%	1.2%	0.873

Note: †Adjusted for population weights only. Rated on a scale from 1 to 5 "Strongly agree" to "Strongly disagree". Test of differences p-value is from logistic regression model mo7xDCM-assessed interaction adjusted for population weights and clinic clustering. *Item E. Stigma is excluded from the depression knowledge summary scale.

V. DISCUSSION

This study examined whether a key part of collaborative care - a depression care manager (DCM) assessment - led to increased depression knowledge, and more positive attitudes and beliefs towards depression treatment compared to non-assessed patients in a group of primary care elderly veterans. Knowledge, beliefs, and attitudes towards depression treatment; stigma; and health care satisfaction did not improve significantly over 7 months and did not differ between patients assessed by depression care managers and those who were not assessed.

There are several potential explanations to explain our finding that contact with depression care managers did not improve patients' attitudes or beliefs about depression treatment over the seven month intervention period. Average exposure to DCMs was two phone contacts over 7 months. Perhaps DCM assessment is not the main exposure that leads to changes in beliefs, but more patient contacts with care managers may be needed to see a significant change in knowledge, beliefs and attitudes. The study sample size was relatively small, but there were no evident trends that might have been strengthened by more observations.

We found few other comparable studies looking at how Collaborative care and DCMs influence patient beliefs and attitudes about depression and depression treatment. In a collaborative care study, Lin et al found that collaborative care patients were twice as likely to match with their preferred treatments compared to patients in usual care [109]. According to this study, patients who obtained their preferred treatment had more rapid reduction in depression symptoms compared to those who did not receive their preferred treatment. Similarly, Chilvers et al found that patients who received their preference for psychotherapy did better

than patients with no preference randomized to psychotherapy. Another study found that patients on an intervention to address older adults' perceived need for care and stigma about depression and treatment had a greater decrease in depression severity and were more likely to remain in treatment compared to those on antidepressants alone [116].

There are several limitations to this study. Our Perceptions About Depression Scale has not been previously validated. Also, measures of self-care behavior, patient activation attitudes and self-efficacy were not available. In addition, participants were not randomized to assessment status; while all patients assigned to collaborative care were supposed to be assessed, the assessment decision was made by either the patient to allow the DCM interview or by the care manager. Depression care managers prioritized their workload to assess patients who have not received prior mental health care. Perhaps in situations where care managers are able to evaluate all depressed patients, higher percentage of mental health patients would be assessed and more frequently contacted. Also, mental health specialty clinics thought their programs provided sufficient patient management. If the relationship between DCMs and mental health care specialists had been different, this may have a resulted in different sample and different outcomes. Furthermore, patients who are already undergoing mental health treatment may have more positive attitudes toward depression treatment than those patients not in mental health care. Thus, there is a possibility of confounding and selection bias. We adjusted for mental health visits for the year prior to enrollment in multivariate analysis and results remained the same.

VI. CONCLUSION

Among depressed primary care veterans who screen positive for PTSD, depression knowledge and beliefs did not improve significantly with one depression care manager assessment. More research needs to be done to understand the pathways by which

collaborative care leads to improvements in depression symptoms. Such an understanding may help depression managers more effectively support and educate these patients to have more positive beliefs towards medications, psychotherapy and mental health treatment which would increase the likelihood of entering and maintaining treatment for their mood disorders. Survey and qualitative research on care manager interactions and patient treatment beliefs may be useful to inform how care managers and other providers can effectively educate and reduce cognitive barriers to patients' treatment initiation and adherence. Other factors suggested by the chronic care model may also be more important, such as provider experience with collaborative care.

Chapter Five: Conclusions

A. Summary & Significance

Individuals with mental disorders in the United States continue to be under-detected and untreated or poorly treated [2]. Depression and PTSD are two debilitating mental disorders that often co-occur [6, 7]. Depressed patients with comorbid PTSD are more severely depressed and more functionally impaired than patients with depression alone [8, 56]. PTSD can be more persistent and more difficult to treat than depression [117], thus finding and facilitating effective treatment for these comorbid conditions are important to Veterans who are suffering from combat-related PTSD. This body of work contributes to the literature on depression and comorbid PTSD and its impact on utilization and costs of health services as well as the outcomes and economic evaluation of collaborative care depression treatment for a depressed PTSD screen positive Veteran primary care population.

My first paper explored the association of mental health need and health utilization behavior and costs. It found that depressed veterans who screen PTSD+ have higher utilization and costs of total outpatient services, primary care depression services, and mental health services than PTSD– depressed patients in primary care. We also found that a greater proportion of PTSD+ depressed patients used antidepressants compared to PTSD– depressed patients. Unlike other studies, we did not find more physical problems, particularly chronic illnesses, in PTSD+ compared to PTSD– depressed veterans in primary care.

My second paper found that collaborative care depressed PTSD+ patients demonstrated a trend toward lower depression severity from 3 to 9 months, but did not find significant improvements in disability. Collaborative care was associated with more

depression-free days and increased outpatient treatment costs for depressed PTSD+ patients over 9 months. Further studies with larger samples are needed to confirm this trend. An average cost of $21 per depression-free-day among PTSD+ depressed patients indicated moderate costs for reduced depression and was comparable to other collaborative care cost-effectiveness studies, but this finding was not statistically significant.

Because patient beliefs, such as patients' perceived need for treatment, are important to treatment initiation and adherence, my third paper examined how collaborative care can impact patient depression treatment beliefs and attitudes through the depression care manager (DCM) assessment which is an interview/discussion designed to educate patients about depression and depression symptoms, monitor their symptoms, and assist with problem-solving cognitive and other barriers to care. In this study, DCM assessment did not lead to more positive attitudes towards depression treatment, less stigma, nor changes in patient satisfaction among PTSD+ depressed patients in primary care. The one time 45-minute DCM assessment intervention did not appear to have a significant influence on depression treatment beliefs at 7 months. This suggests that more DCM follow-up contacts may be needed to influence depression knowledge and beliefs about treatment or perhaps other pathways of how collaborative care improves depression should be explored. There may also have been some selection bias in who DCMs chose to assess or not assess. I could explore use of methods to reduce selection bias such as using a propensity score in the analysis.

B. Limitations

These studies had a several limitations. First, I did not discuss the role of genetics in depression and PTSD. Both depression and PTSD are thought to have genetic vulnerabilities which interact with environmental factors and may influence vulnerability to these disorders. Second, our study samples were mainly older male veterans whose PTSD was likely precipitated by combat trauma, so our findings cannot be generalized to women who's PTSD

were likely precipitated by sexual assault and rape. Also, our results may have limited generalizability to the general non-VA population. Third, in the WAVES studies, the PTSD screening tool did not assess exposure to combat or other trauma, so we cannot determine which traumas led to PTSD. For WAVES patients, it was also unclear which illness was primary. Fourth, in the Mood study (second paper), the PTSD screening tool which was used at the VA at the time was not previously validated or published, so it's possible that some depression and PTSD patients were misidentified. Fifth, for the WAVES Depression Attitudes study, the drop out rate at 7 months was around 25% and there may have been some selection bias in how DCMs selected patients for assessment.

C. Policy implications

The Veterans Health Administration recently mandated primary care screening for depression nationwide and implemented a performance measure to assess quality of care by evaluating concordance with depression clinical practice guidelines [118]. Many clinical practices and clinical guidelines view depression and PTSD as separate illnesses with different causal mechanisms and treatment indications. However, the high rate of co-occurrence of depression and PTSD and some studies suggest that depression and PTSD following trauma could be conceptualized as a single construct of traumatic stress syndrome [77]. At the very least, general medicine providers treating depressed patients should also be aware of the possibility of PTSD comorbidity since depressed comorbid PTSD patients can be more severely depressed, have higher suicidal ideation [56], be harder to treat [117], and exhibit more delayed treatment response to treatment [72]. My first study demonstrates that PTSD+ depressed patients have higher outpatient utilization and are more likely to use antidepressants than patients with depression alone.

Many Veterans with PTSD and depression are afraid of the stigma of mental illness which prevents them from seeking care [91, 107]. Treatment beliefs, attitudes and preferences are

associated with treatment initiation and adherence. PTSD patients take on average 12 years after first onset of symptoms before initiating treatment [119, 120]. Only 65.3% PTSD patients, end up making treatment contact [120]. PTSD patients are high users of medical services and the majority seeks health care in primary care not mental health settings before diagnosis [39]. At the very least, primary care providers should be aware of PTSD, since PTSD+ depressed patients present differently; they are more depressed, more likely suicidal than PTSD− patients. PTSD also complicates other mental health problems. Providing depression and PTSD screening and accessible treatments through primary care could be one way to encourage and facilitate help-seeking for depression and PTSD. However, PTSD screening would need to verify trauma history and functional impairment. A PTSD screening program would likely produce further escalation of PTSD-related disability payments that are legitimate and some that are potentially fraudulent. Our study suggests that multi-faceted collaborative care treatment has some potential to reduce depression severity in patients with PTSD and depression. We also found that depression improvement is accompanied by additional outpatient treatment costs especially for PTSD screen positive depressed patients compared to PTSD screen negative depressed patients.

A central component of collaborative care is the depression care manager's monitoring, evaluation and education of the patient that includes problem-solving barriers to care. We found that changes in knowledge and beliefs about depression and depression treatment did not result from a one-time DCM telephone assessment. More research is needed on how collaborative care works to improve depression and how or if preliminary outcome objectives such as depression knowledge/beliefs/ cognitions, impact depression treatment seeking and adherence. We also found that ethnic minorities (non-whites) were less likely to be assessed by DCMs. More work also needs to be done to explore depression treatment beliefs among ethnic minorities and ways to encourage access to care for minorities.

The rates of major depression, PTSD and generalized anxiety among service members returning from Iraq are reported around 17-19% [91, 121]. After Iraq combat duty, PTSD rates of soldiers and Marines were twice that observed before deployment [91]. As service members return to civilian life, these studies suggest that VA and non-VA providers are going to see increases in outpatient utilization and costs for mental health care services, primary care depression services and usage of antidepressants. Stepped care approaches based in primary care, such as collaborative care depression treatment, could be effective in treating depression and comorbid PTSD. Military health insurers, VA and other health care systems who treat war veterans can use this information to plan for mental health needs of returning Veterans.

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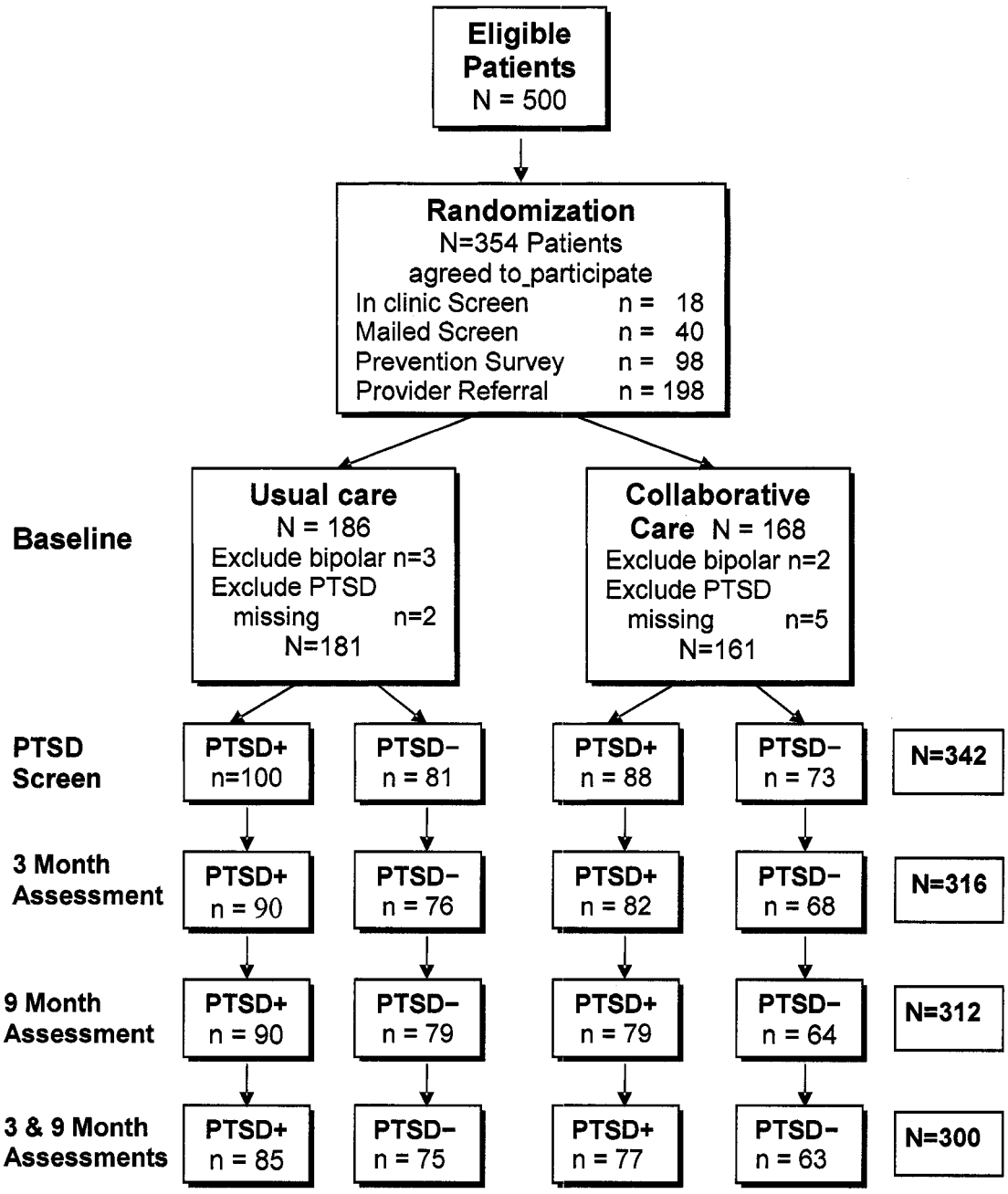
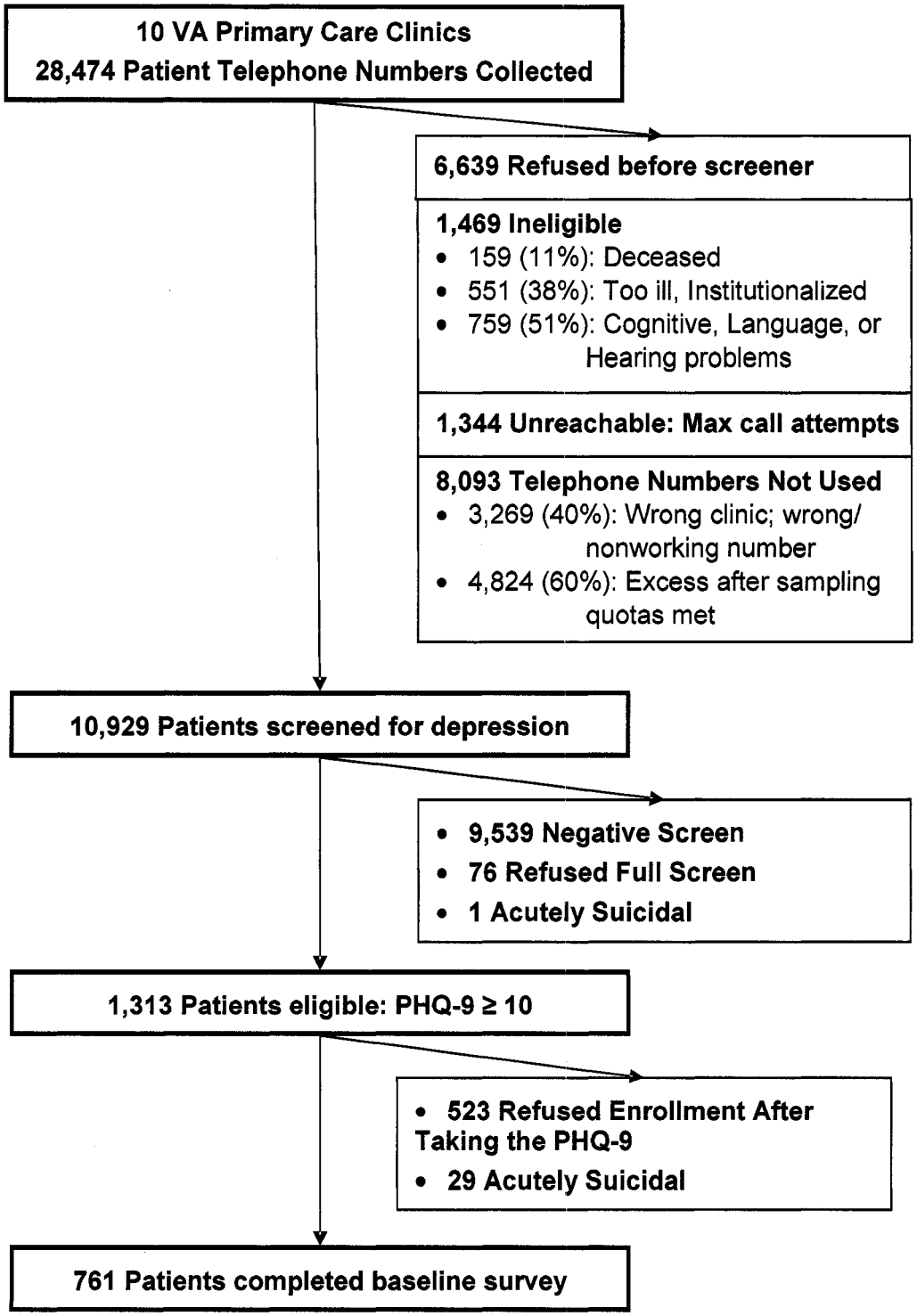
Appendix I: Recruitment and Retention for Mood Study



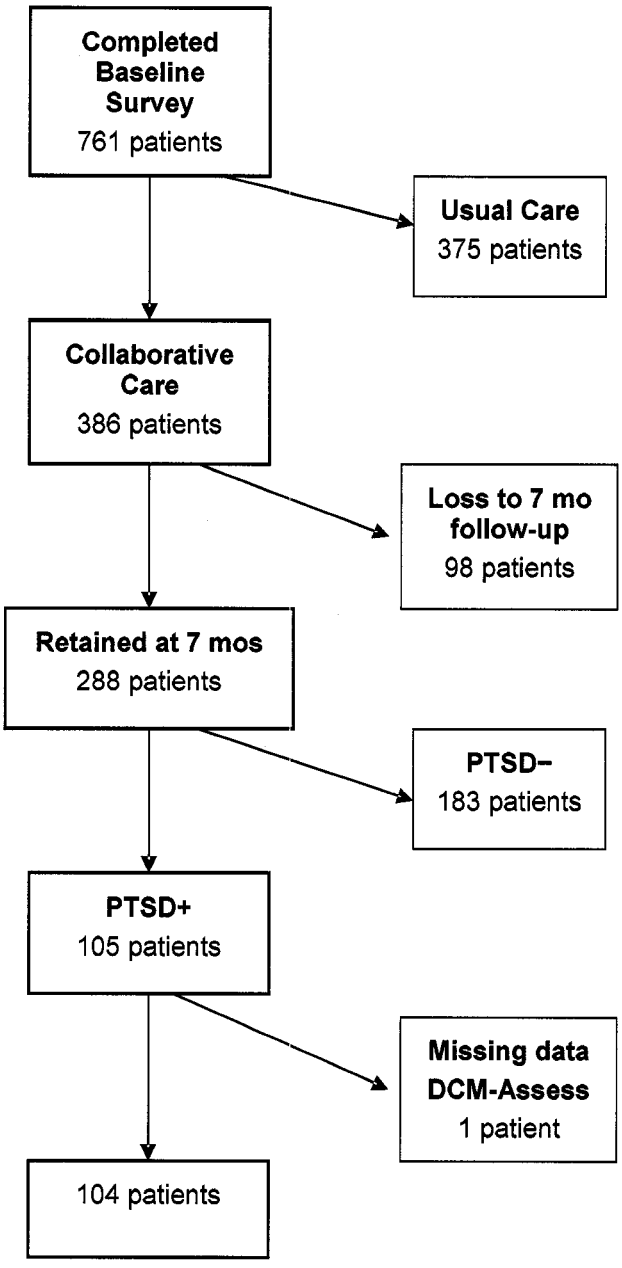
Patients were randomized by firm: two firms to each group.
Modified from Hedrick et al 2003.

Appendix II: WAVES Patient Attitudes Paper
Patient Flow Chart



WAVES Patient Attitudes Paper Patient Flow Chart

(continued from previous page)



Appendix III: PTSD Screening in a Primary care setting
(Mood Study)

Trauma Experiences:

1) Some people have had terrible experiences that others never go through such as:
   a) Being attacked
   b) Being sexually assaulted or raped
   c) Being in a fire or flood or natural disaster
   d) Being in combat
   e) Being in a bad accident
   f) Being threatened with a weapon
   g) Seeing someone being badly injured or killed

   Did any of these experiences ever happen to you? Yes No

If you answered "no to question 1, skip questions 2, 3 and 4.

PTSD Symptoms:

2) Re-experiencing trauma –In the past month, have you been bothered by repeated, disturbing images, thoughts, memories?
   Yes No
3) Avoidance – In the past month, have you been distant or cut off from other people?
   Yes No
4) Hypervigilance – In the past month, have you been "super-alert, watchful or "on guard"?
   Yes No

Comorbid PTSD or PTSD positive screen was defined as having at least one traumatic experience and answering affirmatively to the re-experiencing trauma question. In this primary care population of depressed veterans in Seattle, about 48.5% screened positive for PTSD (PTSD+). PTSD+ patients were evenly distributed between the collaborative care and usual care groups.

Appendix IV: Primary Care PTSD screen (WAVES Studies)[83]

1. Have you ever had any experience in your life that was so frightening, horrible or upsetting that you had recurring nightmares about it or continually thought about it when you did not want to?

1A. Have you had these thoughts or nightmares in the past month?

2. Have you had any experiences that were so frightening, horrible or upsetting that you repeatedly tried hard not to think about it or repeatedly went out of your way to avoid situations that reminded you of it?

2A. Did you try to avoid these situations in the past month?

3. Has there ever been a period in your life where you felt constantly on guard, watchful or easily startled because of a frightening or upsetting experience?

3a. Have you had this feeling of watchfulness in the past month?

4. Has there ever been a period in your life where you felt numb or detached from other people, activities, or from your surroundings because of a frightening, horrible or upsetting experience?

4a. Have you had this feeling of detachment in the past month?

Appendix V: Measurement Matrix 1 – MOOD Paper 2

Variable	Operational Measure/Proxy	Variable Name	Measurement level
Patient Characteristics-Covariates			
Predisposing			
Age	Age	age	Continuous
Sex	Male	male	Binary
Marital Status	Married vs. Divorced/Single/Widowed	mstat	Nominal/Binary
Race	White vs. Other race/ethnicity	white	Binary
Education/	Education level, proxy for	school	Nominal
Socioeconomic status	socioeconomic status	educat (recode)	
Employment status	Working, Retired, On Disability, other	work	Nominal
Enabling			
Living situation	Living alone or with others	alone	Binary
Need			
Baseline Depression Severity	Hopkins Symptom Checklist SCL-20	Sclscore	Ordinal
Chronic disease comorbidity	Chronic Disease Score	cds	Continuous
Baseline Functional Status	Sheehan Disability Scale	sheehan	
Previous Depression	Previous year antidepressant use (MOOD)	med12p	Binary
Main Predictor variable			
Current PTSD symptoms	VA-PTSD screen derived from total # positive PTSD consequences	ptsdtot ptsdcat2	Ordinal, Binary recode
Collaborative care intervention	collaborative care vs. usual care	treat	Binary
Outcome Variables			
Depression Severity	Hopkins Symptom Checklist SCL-20 (MOOD)	sclscort (3 mo), sclscorn (9 mo)	Continuous
Disability/Functional status	Sheehan disability scale	sheehant (3mo) sheehann (9 mo)	Continuous
Cost measures			
Depression related Costs (A)	Depression related Costs	totdepcost_9m	Continuous
• Primary care costs	• Primary care costs	_xpc_9m_pc	Continuous
• Mental health specialty costs	• Mental health specialty costs	_xmhc_9m	Continuous
• Antidepressant medications	• Antidepressant medications	_xrxcost_9md	Continuous
Total non-depression primary care costs (B)	Total non-depression primary care costs	_xallpc_9m_oth	Continuous
Total outpatient costs (A+B)	Total Outpatient costs	Totoptcost_9m	Continuous
Total inpatient costs (C)	Total Inpatient costs	Inptcost_9m	Continuous
Total costs (A+B+C)	Total Costs	Totcost	Continuous

Appendix VI: Measurement Matrix 2 – WAVES Papers 1 & 3

Variable	Operational Measure/Proxy	Variable Name	Measurement level
Patient Characteristics-Covariates			
Predisposing			
Age	Age (deidentified age>80)	age_di	Continuous
Sex	Male	male	Binary
Marital Status	Married vs. Divorced/Single/Widowed	maristat	Binary
Race	White vs. Other race/ethnicity	white	Binary
Education/ Socioeconomic status	Education level, proxy for socioeconomic status	educ, school (dummy)	Ordinal
Employment status	Working, Retired, On Disability, other	work	Nominal
Enabling			
Living situation	Living alone or with others	alone	Binary
Social Support	Total Social Support (reverse coded)	tot_soc_r	Continuous
Barriers to Care	Appointment scheduling	q12a	Nominal
Barriers to Care	Time & effort to go to appointment	q12b	Nominal
Need			
Depression Severity	Patient Health Questionnaire (PHQ-9)	depscore	Ordinal
Chronic disease comorbidity	Seattle Comorbidity Index	sic	Continuous
Alcohol Use	AUDIT-C Screen	audit_c auditccat2	Continuous, Recode to ordinal
Functional Status	Poor health (from General health)	poorhlth	Binary
Anxiety	Anxious feelings in past 6 months	q30	Binary
Panic	Panic Attack in past 6 months	q31a	Binary
Main Predictor variables			
Current PTSD symptoms	PC-PTSD screen	anyptsdc	Ordinal, Binary recode
DCM Assessment	DCM Assessment	dcm_assess	Binary
DCM contacts	2 or more DCM contacts	dcm_hi	Binary
Outcome Variables			
Health Utilization (Paper1)	*(12 mos prior to WAVES survey date)*		
Total outpatient visits	Total outpatient clinic stops (encounters)	op_all12p	Count
• Primary care clinic visits	Primary care clinic encounters	pc_all12p	Count
• Depression-related primary care visits	Depression related primary care encounters	pc_dpress12p	Count
• Mental health specialty visits	Mental health specialty encounters	mh_all12p	Count
• Depression-related mental health visits	Depression related mental health encounters	anymhdep12p	Count
Total inpatient admissions	% inpatient admissions	hosp12p, anyip12p	Count, Binary
Depression-related inpatient admissions	% inpatient admissions	ip_dpress12p, anyipdep12p	Count, Binary recode
Any antidepressant usage	Any antidepressant usage	rx12p	Binary
Cost measures(Paper 1)	*(12 mos prior to WAVES survey date)*		
Total primary care costs (A)	Total primary care costs	pc_all_cst12p	Continuous
• Depression related costs	Primary care depression-related costs	pc_dpress_cst12p	Continuous
Total mental health costs(B)	Total mental health specialty costs	mh_all_cst12p	Continuous
• Depression related costs	Mental health depression costs	mh_dpress_cst12p	Continuous
Total outpatient costs (A)	Total outpatient costs	op_all_cst12p	Continuous
Total inpatient costs (B)	Total inpatient costs	ip_all_cst12p	Continuous
All medications costs (C)	Total medications costs	allrx_adj_cost12p	Continuous
• Antidepressant medications	• Antidepressant medications	adrx_adj_cost12p	Continuous
Total costs (A+B+C)	Total costs	totcost12p	Continuous

Variable	Operational Measure/Proxy	Variable Name	Measurement level
Health Beliefs/Attitudes			
Perceptions About Depression	7-item Depression attitudes scale at baseline, 6 months & difference between baseline & 6 months.	depka_b (baseline) depka_6 (6 mos) depka_06 (diff.)	Continuous
Antidepressant knowledge	Antidepressant knowledge at baseline & 6 months	q56a / rxdepbtr; s_40a / rxdepbtr_6	Nominal/binary
Biological basis of depression knowledge	Biological basis of depression knowledge at baseline & 6 months	q56b / braindep; s_40b / braindep_6	Nominal/binary
Intention to take antidepressants	Intention to take antidepressants at baseline & 6 months	q56c / deprxdo s_40c / deprxdo_6	Nominal/binary
Talk therapy belief	Belief about psychotherapy helpfulness at baseline & 6 months	q56d / tlkhlthp s_40d / tlkhlthp_6	Nominal/binary
Perceived treatment need	Perceived treatment need at baseline & 6 months	q56f / ndtrtdep s_40f / ndtrtdep_6	Nominal/binary
Intention to accept diagnosis	Intention to accept depression diagnosis at baseline & 6 months	q56g / acptdep s_40g / acptdep_6	Nominal/binary
Treatment expectation	Positive treatment expectation at baseline & 6 months	q56h / ehbtrhlp s_40h / ehbtrhlp_6	Nominal/binary
Employer stigma	Not want employer to know about depression at baseline & 6 months	q56e / noemphlp s_40e / noemphlp_6	Nominal/binary

Appendix VII: WAVES Utilization and Costs Variables Definitions, Assumptions, & Data Sources

Utilization Measures	*Definitions & Assumptions*	*VA Data source*
a. Total outpatient visits	Drop inpatient-related outpatient care. One encounter per care type (mental health or primary care) per day is retained.	OPC
i. Primary care visits	One encounter for primary care per day. Clinic codes: 301 (GIMC), 323 (primary care), 322 (women's health clinic), 318 (geriatric clinic), 319 (geriatric eval & mgmt), 350 (geriatric primary care)	OPC
1. Depression-related primary care visits	PC clinic code above & Depression Dx codes: 296.2, 296.3, 298.0, 300.4, 309.1, 311	OPC
2. PTSD-related primary care visits	PTSD dx: 309.81	OPC
ii. Mental health visits	Clinic stop codes: 499-600 Excludes phone consults (527, 528, 539, 536, 537, 542, 545, 546, 569, 579) One encounter for mental health per day.	OPC
1. Depression-related mental health visits	Clinic stop codes: 499-600. Excludes phone consults (see above). Depression Dx codes: 296.2x, 296.3x, 298.0, 300.4, 309.1, 311	OPC
2. PTSD-related mental health visits	PTSD dx: 309.81 OR PTSD clinic: 516 (PTSD-group), 524 (active duty sex trauma), 540 (PTSD-individual), 561 (PTSD-group)	OPC
iii. Outpatient Prescriptions		PBM
1. Any Antidepressant usage	Antidepressants = Amitriptyline, Amoxapine, Buproprion,Citalopram, Clomipramine, Desipramine, Doxepin, Escitalopram oxalate, Fluoxetine, Fluvoxamine, Imipramine, Maprotiline, Mirtazapine, Nefazadone, Nortriptyline, Paroxetine, Phenelzine, Protriptyline, Sertraline, Trazodone,Venlaflaxin Delete if dose < threshold doses (J. Kirschner) if Trazadone and DAILY_DOSE < 300 mg if Amitriptyline & DAILY_DOSE < 50 mg if Mirtazapine & DAILY_DOSE < 45 mg	PBM
b. Any Inpatient Admissions	1 record = 1 admission	PTF
i. Depression-related inpatient admission (probably will not present)	Primary dx: 296.2x, 296.3x, 298.0, 300.4, 309.1, 311	PTF

Cost measures	*Definitions & Assumptions*	*VA Data source*
a. Total Outpatient Costs	All costs are matched to outpatient visits. Missing costs are replaced with mean costs for clinic. Costs are summed per subject per day per care type (mental health or primary care).	DSS
i. Primary care Costs	(see above) No primary care costs missing that are not in outpatient cost look-up table.	DSS
1. Depression-related primary care costs	Depression Dx: 296.2x, 296.3x, 298.0, 300.4, 309.1, 311	DSS
2. PTSD-related primary care costs	PTSD Dx code: 309.81	DSS
ii. Mental health visits costs	Missing replaced with mean costs for clinic. If costs are still missing (n=7), then costs are set to $0. Costs are summed per subject per day per mental health care.	DSS
1. Depression-related mental health costs	Depression Dx: 296.2x, 296.3x, 298.0, 300.4, 309.1, 311	DSS
2. PTSD-related mental health costs	PTSD Dx: 309.81 OR PTSD clinic: 516, 524, 540, 561	DSS
iii. Outpatient Prescriptions	Direct costs Indirect-to-Direct Ratio from COVES study	PBM DSS
1. Antidepressant costs	Direct costs from PBM x Indirect-to-Direct Ratio- derived from Ratio in COVES study	PBM DSS
2. Total medications costs	Direct costs from PBM x Indirect-to-Direct Ratio derived from ratio in COVES study	PBM DSS
b. Inpatient costs	All DSS costs are matched to inpatient admissions (PTF). Uses costs with only 1 record per encounter per admission. If inpatient cost is missing, cost is replace with mean inpatient cost for DRG. If still missing & unmatched (in DSS, not PTF: n=6), then cost is set to $684.	DSS PTF
c. Total Health Costs	Inpatient (B) + Outpatient costs (A)	

Note: All costs are adjusted to 2005 costs with the medical component for the consumer price index

Patient Identification:

- **Time Period for WAVES Utilization paper:**
  12 mos prior from WAVES Jun 2002-Jun 2003.
- **WAVES start date is the date of enrollment or survey.**

Abbreviations:

PBM – VA Pharmacy Benefits Management system (outpatient pharmacy visits and costs)
OPC – VA Outpatient Care File (outpatient visits)
COVES – Cost and Value of Evidence-based Solutions for Depression study
(includes WAVES patients and greater number of depressed patients across WAVES clinics)
DSS – VA Decision Support System for outpatient utilization and costs.
PTF – VA Patient Treatment File (for inpatient admissions)

Appendix VIII: Patient Health Questionaire-9 (PHQ-9)
from WAVES Computer Assisted Telephone Interview

I'm going to start by asking you about some problems common to everyone at times.

Q1A Over the last 2 weeks, how often have you been bothered by:
Feeling little interest or little pleasure in doing things.

1 Not at all
2 Several Days
3 More than 1/2 the days
4 Nearly every day
7 UNCODABLE
8 DON'T KNOW
9 REFUSED

Q1B Over the last 2 weeks, how often have you been bothered by:
Feeling down, depressed or hopeless.

1 Not at all
2 Several Days
3 More than 1/2 the days
4 Nearly every day
7 UNCODABLE
8 DON'T KNOW
9 REFUSED

Q1C Over the last 2 weeks, how often have you been bothered by:
Trouble falling asleep, staying asleep, or sleeping too much.

1 Not at all
2 Several Days
3 More than 1/2 the days
4 Nearly every day
7 UNCODABLE
8 DON'T KNOW
9 REFUSED

Q1D Over the last 2 weeks, how often have you been bothered by:
Feeling tired or having little energy.

1 Not at all
2 Several Days
3 More than 1/2 the days
4 Nearly every day
7 UNCODABLE
8 DON'T KNOW
9 REFUSED

Q1E Over the last 2 weeks, how often have you been bothered by: Poor appetite or overeating.

1 Not at all
2 Several Days
3 More than 1/2 the days
4 Nearly every day
7 UNCODABLE
8 DON'T KNOW
9 REFUSED

Q1F Over the last 2 weeks, how often have you been bothered by: Feeling bad about yourself, or feeling that you are a failure or have let yourself or your family down.

1 Not at all
2 Several Days
3 More than 1/2 the days
4 Nearly every day
7 UNCODABLE
8 DON'T KNOW
9 REFUSED

Q1G Over the last 2 weeks, how often have you been bothered by: Trouble concentrating on things, such as reading the newspaper or watching television.

1 Not at all
2 Several Days
3 More than 1/2 the days
4 Nearly every day
7 UNCODABLE
8 DON'T KNOW
9 REFUSED

Q1H Over the last 2 weeks, how often have you been bothered by: Moving or speaking so slowly that other people could have noticed. Or the opposite - being so fidgety or restless that you have been moving around a lot more than usual.

1 Not at all
2 Several Days
3 More than 1/2 the days
4 Nearly every day
7 UNCODABLE
8 DON'T KNOW
9 REFUSED

Q1I Over the last 2 weeks, how often have you been bothered by: Thoughts that you would be better off dead or of hurting yourself in some way.

1 Not at all
2 Several Days
3 More than 1/2 the days
4 Nearly every day
7 UNCODABLE
8 DON'T KNOW
9 REFUSED

Vita

Domin Chan was born in Washington, DC. She earned a Bachelor of Science from McGill University in Montreal, Quebec, Canada and a Masters in Health Science from Johns Hopkins University in Behavioral Science and Health Education. She has lived and worked in the U.S., Canada, and Singapore for a diverse range of health care organizations. As a Health Specialist consultant for the World Bank, she edited a book on Social Protection in the Middle East and North Africa and conducted cross-country comparisons of health care expenditures. As a health administrator, she managed the Johns Hopkins Women's Health Clinic and worked on strategic planning, cost reduction, and investment analysis for a private health care group in Singapore. As a health educator, she managed asthma programs for inner city youth in Washington, D.C. and produced a weekly health affairs radio program. She will receive her Doctor of Philosophy in Health Services at the University of Washington in 2007.