A Simulation Model to Predict Long-Term Posttraumatic Stress Disorder Prevalence Following Operation Iraqi Freedom and Operation Enduring Freedom:
Executive Summary

by

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B.S. Physics
Georgetown University, 2010

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Abstract

Combat-related Post-Traumatic Stress Disorder (PTSD) poses complex challenges for policymakers that simulation modeling and analysis could help elucidate. True population prevalence and future clinical need are highly uncertain, because individuals' PTSD symptomatology may fluctuate in time. Though we increasingly measure policy outcomes, outcome metrics often address direct, short-term effects, so the impact on long-term prevalence is unclear. The PTSD burden involves a diverse set of actors across domains who independently make decisions based on incomplete information. Simulation modeling and analysis can indicate how these local aspects of the PTSD burden jointly impact long-term prevalence and identify leverage points for PTSD mitigation.

This study demonstrates the results of a simulation model that predicts PTSD prevalence and clinical demand over the fifty years following Operations Enduring Freedom (OEF) and Iraqi Freedom (OIF). The model considers PTSD risk, onset, recognition, care-seeking, and treatment.

The simulation results indicate the extent to which PTSD is chronic, prevalent, and resistant to treatment. The best-case model predicts that 11-16% of OEF/OIF combat veterans will maintain a long-term need for PTSD services, and as many as 23% of OEF/OIF combat veterans will seek PTSD-related health care at least once in their lives.

This study has three main policymaking implications. First, study predictions regarding long-term PTSD prevalence and clinical demand can be used for clinical planning and resource allocation over time. Second, baseline model results indicate the long-term limits of current best practice PTSD mitigation efforts. Third, the study identifies effective policy levers by indicating the factors with the greatest direct impact on long-term PTSD prevalence.

Problem Statement, Key Themes and Study Implications

1.1 Problem Statement

The military-related Posttraumatic Stress Disorder (PTSD) burden in the United States presents complex challenges that implicate a diverse set of actors over the long term. At the individual level, PTSD is persistent, difficult to identify and resistant to treatment. Symptomatology may follow a complex trajectory that differs from person to person, whereby symptoms may present, remit, and recur at unexpected times. Similarly, PTSD poses population level challenges. A true prevalence rate is in part obscured by individuals' changing symptomatology and cultural counter-incentives to accurately report symptoms. The disorder's uncertain prevalence and resistance to treatment make operational planning and clinical resource allocation particularly challenging.

The response to PTSD involves an array of decisionmakers, including individual servicemembers and veterans, command leaders, clinical policymakers and clinicians. These individuals make decisions that span a broad range of domains impacting the PTSD burden directly or indirectly, including decisions governing combat exposure and PTSD risk, PTSD recognition and treatment. Though decisions across domains are often made independently, they may have significant, unintended consequences in other decisional areas that are not fully understood. For example, while outcome metrics have been put into place to gauge the effectiveness of many policies (e.g. screening programs), these metrics are often focus only on whether the policy in practice works as designed. Little is known about how interventions from across domains jointly impact universal metrics, including long-term PTSD prevalence or clinical usage. The current study uses a simulation modeling approach to describe the OEF/OIF combat-related PTSD burden over the long-term.

Why Model PTSD?

A model is a simplified representation of the causal and structural mechanisms of interest underlying a complex phenomenon. In the field of military mental health, current models are primarily descriptive. For example, theoretical psychology models explain the mechanisms and risk factors underlying PTSD onset or treatment. Similarly, many empirical studies apply these representations to quantify the relative contributions of each factor of interest to population level

prevalence phenomena. Simulation models can complement empirical studies by predicting the implications of empirically observed phenomena under a range of hypothetical future conditions.

The Present Model

This study develops and presents a systems approach and simulation model designed to predict PTSD prevalence and clinical usage over the decades to come using known characteristics of the disorder and its treatment. This model combines and applies empirical findings regarding the rates and timing of PTSD onset, its long-term trajectories and prospects for treatment, as well as cultural and policy studies regarding the social factors underlying PTSD recognition and care-seeking within the US military and veteran communities and describe the DoD and VA organizational response to the PTSD burden.

The current study systemizes phenomena from across three areas of intervention, or domains, namely PTSD recognition, care-seeking, and treatment, in order to assess their long-term implications for population PTSD prevalence and clinical demand for treatment services. It demonstrates how a systems approach to the psychological and decisional processes governing PTSD prevalence over time can improve our understanding of the structure and dynamics of the PTSD burden as well as predict prevalence, compare empirical studies, and assess policy options. This study does not consider policies that impact rates of traumatic exposure. Rather, the model focuses on how the PTSD burden can be addressed henceforth through recognition, care-seeking and treatment policies, given the historical rates of deployment and traumatic exposure during OEF/OIF.

1.2 Key Themes

The research presented in the current study highlights three main themes for military policymakers to consider in order to improve the effectiveness and robustness of policy decisions. The near-term dynamics predicted within the model offer novel insights for current military policymaking. These results impinge on current readiness and the effectiveness of current military mental health policies, as well as veterans' long term mental health. The study indicates the following implications for military policy in particular:

1) *Population prevalence metrics demonstrate complex dynamics in the short term that complicate planning and policy assessment.*

Model results indicate that the years following the current conflicts will be characterized by complex changes in prevalence rates, including non-linear changes in the percentage of servicemembers with probable PTSD and the percentage of servicemembers in treatment. Combat veterans may develop new cases of PTSD and symptomatology after irregular delay periods and relapse following treatment or further traumatic exposure. These dynamics complicate policymakers' operational and clinical planning, as prevalence rates may increase or decrease irregularly from year to year due to systemic effects. Further, these effects obscure post hoc assessments of whether programs were successful in mitigating the PTSD burden.

2) *The true PTSD prevalence rate is unknown but greater than observed rates because individuals may not experience symptoms or recognize their symptoms as indicative.*
Policymakers are able to draw only on clinical usage data and screening results to estimate PTSD prevalence. However, individuals may not experience symptoms in all periods, nor recognize their symptoms as indicative of possible PTSD. The model presents a ratio of in-treatment to active PTSD cases in each year that may be used to predict active PTSD case levels in the short term based on usage in military health care facilities. Similarly, model results may be applied to predict the long-term prevalence of PTSD among career servicemembers. The study also predicts annual clinical demand to aid in clinical planning. The study thus demonstrates the best-case limits of current recognition, care-seeking and treatment programs in terms of mitigating the PTSD burden.

3) *Model results identify potential bottlenecks in PTSD mitigation and can predict the impact of future policies.*
The study includes sensitivity and policy analyses designed to indicate how responsive PTSD prevalence is to various aspects of the mental health system. This analysis identifies the factors that most constrain PTSD mitigation in the contexts studied in order to assess and directly compare the expected effects of changes within the system. Understanding these factors and their interactions is essential for policy development; model results indicate that under multiple system constraints, no single-domain, "silver bullet" intervention will suffice to ameliorate the PTSD burden, rather a concentrated effort is required involving policies across domains.

This study also demonstrates how the model could be used to predict and compare the effects of policies across common, universal metrics (e.g. the prevalence rate) before implementation. In future work, this approach could be developed into a tool for military mental health policymakers. Further, comparing predicted and actual results from policy changes after the fact could help improve combat-related PTSD onset and treatment research, offering new insights into the causal relationships between psychological and social factors governing the PTSD burden.

1.4 Implications for Research and Policy

Results indicate that even with state-of-the-art treatments and optimistic assumptions regarding PTSD recognition and care-seeking behavior, the PTSD burden of the current wars will be chronic and substantial at both the individual and population levels. Study conclusions largely fall into three categories: implications for PTSD prevalence, recognition and treatment (Table 1).

Domain	Policy Implications
Prevalence	1) Relative to recognition and treatment quality, care-seeking represents the single most significant bottleneck to decreasing long-term PTSD prevalence.
	2) PTSD recognition policies and screening programs are beneficial on the individual-level but are not expected to decrease long-term population prevalence directly.
	3) Empirical policy analyses should be conducted to understand macro-level implications of policies (e.g. in terms of population prevalence) and control for complex population dynamics from year to year.
Recognition	1) PTSD screens should be conducted over an extended window.
	2) Prevalence rates are highly time dependent and should be cited with caution.
Treatment	1) Care follow-up has a significant effect on long-term outcomes.
	2) Outreach to encourage acyclical care-seeking could help avoid demand spikes.

Table 1. Implications of the current study for policy.

Implications for PTSD Prevalence

Care-seeking factors have the greatest direct effect on long-term PTSD prevalence.
Under the baseline, best-case model, the parameters governing care-seeking—specifically

the probability of seeking care and treatment dropout—have the greatest direct effect on long-term PTSD prevalence rates relative to recognition and treatment quality factors, holding all other parameters constant. However, the empirical literature has shown that these factors exhibit the greatest variance and uncertainty across units and veteran communities, suggesting that significant uncertainty and variation will exist in terms of long-term PTSD population prevalence across groups.

Improving the factors encouraging care-seeking and limiting treatment dropout is predicted to have the greatest positive effect on long-term outcomes. Similarly, knowing the care-seeking attributes of a particular community or subpopulation can go a long way toward predicting its future prevalence.

PTSD Recognition does not have a major direct impact on long-term PTSD prevalence relative to other factors.

Model results indicate that factors related to PTSD recognition have a relatively low direct effect on long-term, population PTSD rates relative to care-seeking and treatment quality parameters. Although PTSD recognition is a necessary condition for treatment entrance, most symptomatic individuals know they have a possible PTSD case.

Widespread screening and education programs are therefore unlikely to observably impact *long-term population prevalence* metrics. However, while they may not appear successful with respect to macro-level outcome metrics, such programs are likely to help *individual servicemembers,* who may not otherwise be aware of their PTSD risk and how to identify symptoms, to access the mental health care system. For those servicemembers and veterans who are unfamiliar with PTSD, screening and education programs remove the key barrier along the path to recovery.

Model results indicate that the principal bottlenecks in addressing the PTSD burden involve care-seeking and treatment, which are downstream of recognition. Thus recognition and screening programs should be designed to encourage care-seeking and reduce stigma in addition to their primary identification role, in order to take advantage of the secondary effects on care-seeking behavior that are most likely to impact long-term prevalence.

Empirical policy analysis should assess policies' impact on macro-level effects such as

population prevalence and incorporate the complex natural population dynamics of the system.

Outcome data are increasingly being collected and analyzed to understand the impact of the various policies that are implemented to address the PTSD burden. These data largely assess the short-term, local effect of the intended policy, which is essential to verify that the policy works as designed.

However, such studies typically do not capture the effects of the policy on system-level metrics, such as long-term prevalence or clinical demand. This study demonstrates how these macro-level effects can be compared across policy domains. Systems-level policy analysis should be conducted in order to validate that a program in fact has the intended effect on the military mental health system writ large and to help choose among policy investments across domains.

Similarly, policy analyses should be designed to control for the natural population dynamics of the system under the status quo without the policy. The current study indicates that, especially during a war period, population symptomatology and care-seeking dynamics are complex. Thus, a dramatic change in population prevalence (or any other metric) from one year to the next may occur even without a policy intervention. Analysts should strive to determine the degree to which observed changes from year to year can be attributed to the policy change as compared with the natural dynamics of the system under the status quo.

Implications for PTSD Recognition

PTSD screens and prevalence surveys should be designed to be robust to the symptom fluctuation that an individual may experience.

This model indicates the extent to which symptom fluctuation causes single screens to under-report prevalence because individuals who are asymptomatic at the time of the screening event may not be observed with possible PTSD.

On the individual level, any single screen may be less likely than expected to positively identify an active case of PTSD because 20-45% of those with an active PTSD case may be asymptomatic at any given time[1]. The screen provides a snapshot of the individual's

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[1] In addition, the screening instrument's false positive rate and counter-incentives to accurately report symptoms (e.g. stigma, fear of professional repercussions) would cause further under-reporting.

symptomatology over a short time period and may not positively identify an individual with possible PTSD if he is in a temporary asymptomatic period. Further, the difficulty of identifying when a PTSD case has remitted permanently versus when symptoms have subsided temporarily complicates clinicians' and command leaders' ability to accurately identify and track individuals' PTSD cases.

Surveys and screening programs predominantly use measures of current PTSD symptomatology. The current study demonstrates how complementary measures of active PTSD that include temporarily asymptomatic cases can help provide a more complete picture of the PTSD burden for policymakers. Such metrics, measurable over a longer time window via continued follow-up after surveys and treatment, could help account for the true prevalence of active PTSD cases, and not only the subset of the active PTSD population that experiences symptoms at the moment of the screen. These improvements could improve decisionmakers' ability to ensure continued care for servicemembers and veterans with PTSD.

Prevalence rates depend considerably on symptomatology time dynamics and thus should be cited with caution.

Similarly, on the population level, true PTSD prevalence changes dramatically during the war period and shortly thereafter as delayed PTSD cases gradually set on and servicemembers redeploy at greater PTSD risk. Findings from the current study suggest that prevalence should be expected to vary with respect to the timing of an assessment, consistent with empirical results (Ramchand, et al., 2010).

This study demonstrates how drastically PTSD prevalence can change over time, especially in the short-term. Model results are consistent with a broad range of empirical prevalence estimates, even though the empirical studies present surprisingly different statistics, because these studies differ considerably in terms of the measure of PTSD that they use and the timing of the assessment relative to the sample population's deployment[2]. This result suggests that a considerable component of an empirical prevalence estimate can be explained by the time dynamics of symptomatology and that a prevalence estimate is not simply a static, inherent

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[2] For example, a study of Post-Deployment Health Assessment responses from Active Duty Army servicemembers in 2004-2005, 3 months after deployment, found a current PTSD prevalence of 6.2%. On the other side of the range, the VA reported an ever-PTSD to date rate of 31.5% among VA care-seeking veterans through 2015. After controlling for study timing and the definition of PTSD (currently symptomatic or ever-PTSD to date), model results match both empirical studies closely.

measure of the population[3].

On the population level, the high percentage of asymptomatic active PTSD cases in any period suggests that any single screen or empirical study is likely to underestimate the true PTSD rate, complicating decisionmakers' ability to plan and allocate resources effectively. On the clinical side, this effect poses the threat of unanticipated demand spikes from period to period according to changes in symptomatology or observation. On the command side, such period to period changes could cause unanticipated personnel shortfalls that threaten operational readiness for current or future conflicts.

Thus to the extent possible, empirical results should be used with caution. The present model results suggest that any single empirical prevalence rate provides a necessary but incomplete snapshot of the PTSD burden among a particular cohort at a fixed point in time. Therefore decisions based on prevalence should be made with caution and incorporate multiple studies with complementary research designs and timing.

Implications for Treatment

More likely than not, an episode of care will be unsuccessful, therefore continued treatment follow-up is essential.

Policies to encourage treatment follow-up are paramount, because it should be assumed that even the best treatments will not succeed in permanently mitigating symptoms. In the policy analysis, a Treatment Follow-up policy that reduced the probability of dropout and increased the probability of treatment re-entry after an individual's first episode of care was as effective as a policy to invest in research of new treatment modalities. Emphasis could be also added on treatment follow-up as part of care-seeking education programs, encouraging servicemembers and veterans to pursue regular and frequent follow-on care.

A number of factors combine to limit the effectiveness of even the best treatment modalities in practice. This study considered the effect of dropout, treatment efficacy and PTSD recurrence following successful treatment. With these factors combined, baseline model results

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[3] These figures should be revised often because of the effect that timing can have on rates. For example, the VA currently claims that the ever-PTSD rate among the full veteran population is near 20% based on the 2008 RAND report, rather than the approximately 30% rate among care-seeking veterans in recent years (Reno, 2012). The current model results suggest that the ever-PTSD rate have since increased to upwards of 27-30%, as delayed onset and multiple deployments cases increasingly display PTSD.

indicate that in the best case only 34% of episodes of care are successful. Further, of successfully treated cases, at least one in four is expected to have a recurrence of PTSD. The current model did not consider the effect of other factors that could impact treatment efficacy such as time since trauma or onset, resource constraints, clinician skill and patient alliance, nor PTSD case complexity. These factors are likely to decrease the actual probability of permanently successful treatment even further.

Peacetime measures to encourage care-seeking could help mitigate clinical capacity constraints.

Historically, mental health concerns achieve cyclical political importance and public attention during war periods, and tend to fade in priority after a conflict (Solomon, 1995). These factors may decrease individuals' likelihood of seeking care until a future conflict or war draws newfound attention to and acceptance of military mental health issues. For example, Vietnam veterans demonstrated a spike in traumatic response and care-seeking during the Gulf War, triggered by media reports of that war (Peterson, 1991).

The current model demonstrates that a significant percentage of the PTSD population has observed symptomatology but does not seek treatment in any particular period. However, in periods where mental health issues are called to the forefront, so that the probability of care-seeking increases, a sudden increase in demand for PTSD care of as much as double the care-seeking population may overwhelm mental health clinics. The newfound attention to military mental health issues during a conflict or war may encourage those servicemembers and veterans bearing persistent symptomatology from prior conflicts to seek care.

These spikes in attention and clinical demand can unfortunately lead to poorer treatment by spreading clinical resources too thin among both veterans of prior wars and newly returning veterans. Model results suggest that policymakers should anticipate a significant latent population of active PTSD cases not currently seeking treatment. Therefore, policies should be developed to encourage care-seeking among this population in periods of low clinical demand in order to help smooth clinical usage and mitigate future demand spikes that may arise.

The rest of this paper is structured as follows. The Modeling Structure section describes the purpose, structure, and assumptions of the model used in this study. The Results section

presents the key study findings. Finally, the Appendix includes a brief literature review, further details regarding the model structure, algorithm, and parameter values, and references. Readers may consult the thesis on which this paper in based for a more detailed explanation of the model, complete results, and further study conclusions and policy implications.

Modeling Structure

2.1 Purpose

The purpose of the study is to understand how the temporal dynamics of PTSD symptomatology and the social factors influencing care-seeking behavior of the PTSD population impact PTSD prevalence and clinical demand over time. This study uses a probability-based (Monte Carlo) simulation (referred to as the Longitudinal Model) of American servicemembers deployed to Iraq and Afghanistan as part of Operation Iraqi Freedom (OIF) and Operation Enduring Freedom (OEF) in order to predict 1) the number of combat veterans from these two wars who exhibit PTSD and 2) the demand for DoD and VA clinical resources for PTSD in each calendar year over five decades following combat.

This model creates and tracks a simulated population of OEF/OIF servicemembers over the war period and for 50 years thereafter. To do so, three factors are considered that impact an individual's use of clinical treatment resources for PTSD: PTSD "caseness" (i.e. whether the individual has PTSD symptoms), PTSD recognition, and treatment. The model randomly assigns symptom onset, recognition and treatment events to each simulated servicemember in each period, tracking these changes for each simulated servicemember over the length of the study. The Longitudinal Model structure is described in detail in the Appendix.

The study also considers how various factors impact population prevalence over time and thus which types of policies are most likely to promote population health under various conditions. The study considers three groups of policies targeting PTSD, those designed to: 1) encourage recognition of PTSD by educating communities about military mental health issues or requiring PTSD screening, 2) enable PTSD treatment by encouraging care-seeking behavior or making clinical resources more available, or 3) improve PTSD treatment efficacy by funding

research[4]. A policy can be simulated by a change in one or more parameters within the model, in order to test which policy changes are likely to have the greatest impact on key outcome metrics and which steps along the paths to remission most limit population health. This study tests a sample policy from each group in order to demonstrate the approach and draw general conclusions about tradeoffs among these policies.

Due to lack of information about future deployment rates to OEF and a drawdown strategy, the model only considers deployments in 2003-2014. Actual OEF deployment and deployment to similarly hostile areas in the region continue through the present. Thus, the predicted number of servicemembers with PTSD and demanding clinical services in each year should be considered as a lower bound.

2.2 Model Assumptions

Baseline Model

The baseline model is designed to describe a "best case" prevalence estimate by assuming that all mitigation parameters (i.e. those affecting recognition, care-seeking, and treatment) are at the most favorable levels that have been reported. This model therefore provides a lower bound on PTSD prevalence over time that indicates the limits of the current best practices for PTSD mitigation. The baseline model assumes that 1) PTSD recognition and care-seeking probabilities are at the high end of their empirical ranges, 2) any servicemember who seeks treatment is able to enter treatment immediately and receives the most effective treatment possible 3) treatment dropout probability is at the low end of the empirical range and 4) the probability of PTSD relapse following successful treatment is at the low end of the empirical range.

Alternative Model Specifications

In practice, aspects of mitigation may be less effective than the best case estimates underlying the baseline model or may be otherwise adversely constrained by logistical factors. Therefore alternative models are also tested that relax the optimistic assumptions underlying the

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[4] Another group of policies includes those designed to alter the probability of PTSD by changing the frequency and severity of combat exposure, and the resilience training servicemembers receive. These are not considered because these policy options are no longer feasible for the OEF/OIF population.

baseline, best-case model in order to reflect the lower quality conditions often seen in practice[5]. These models are described in more detail in the Appendix.

One alternative model includes realistic care-seeking and treatment parameters, maintaining the best-case recognition parameters. The other alternative model includes realistic care-seeking, treatment and recognition parameters. Realistic care-seeking parameters reflect individuals' decreased willingness to seek care in practice due to stigma, professional concerns, or geographic factors. Realistic treatment parameters reflect decreased treatment quality and increased drop out probability caused by the use of non-Evidence-Based Treatments, clinical resource constraints that inhibit patient follow-up, and patient case complexity, among other factors. Realistic recognition parameters reflect decreased recognition probability caused by stigma, bureaucratic and professional concerns that limit servicemembers' willingness to accurately report symptoms on non-anonymized screens.

Results

Table 2 summarizes key findings from the best-case (baseline) model as well as the two alternative models.

Domain	Metric	Best-Case Model (Baseline)	Realistic Care-Seeking & Treatment Model	Realistic Recognition, Care-Seeking, and Treatment Model
Prevalence	Long-term Currently Symptomatic Rate (% of servicemember population)	6-8%	13-15%	14-15%
	Long-term Active Case Rate (% of servicemember population)	11-16%	19-21%	21-23%
	Long-term Ever-PTSD Rate (% of servicemember population)	29%	29%	29%
Treatment	Long-Term Ever-Treated rate (% of ever-PTSD population)	80%	63%	48%
	Successfully treated and permanently remitted (% of ever-treated population)	59%	21%	21%

Table 2. Key findings by domain for the baseline and alternate model specifications.

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[5] All models assume the same combat exposure and PTSD onset mechanism, so that differences in PTSD prevalence and clinical usage are attributable only to differences in recognition, care-seeking behavior and treatment efficacy.

3.1 Best-Case (Baseline) Model Results

PTSD Prevalence

Figure 1 shows the best-case model-predicted percentage of OEF/OIF Army and Marine servicemembers in each year who are affected by PTSD[6]. Three measures of PTSD prevalence are presented: 1) the servicemembers currently symptomatic for PTSD in each indicated year, i.e. those who would screen positive on a hypothetical screen aimed at identifying current symptoms, 2) those who have an active PTSD case in each indicated year but may not be symptomatic, and 3) those who have ever experienced PTSD through the end of each indicated year. Each metric represents a different, complementary view of the PTSD prevalence at a given time; no one measure fully describes the policy challenges posed by the PTSD burden.

The baseline model predicts that 29% of servicemembers deployed under OEF/OIF through 2014 will experience PTSD at some point through 2065, consistent with empirical estimates and current VA health records. Over the long run, 11-16% of all servicemembers are expected to maintain an active case of PTSD over the long term. Under realistic recognition, care-seeking, and treatment assumptions, the Active Case rate is persistent in time at as high as 20-23%.

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[6] The model does not include Navy or Air Force servicemembers, and deployment characteristics may have changed drastically as a result of operational tempo changes since the latest (2011) publicly available data used in this study. As such, the total number of servicemembers in the model (1.03 million) is far lower than the reported number of servicemembers involved in OEF/OIF through 2014 (2.7 million) (VA, 2015). Model-generated metrics are expressed in terms of the percentage of servicemembers they represent, so that results may be scaled accordingly.
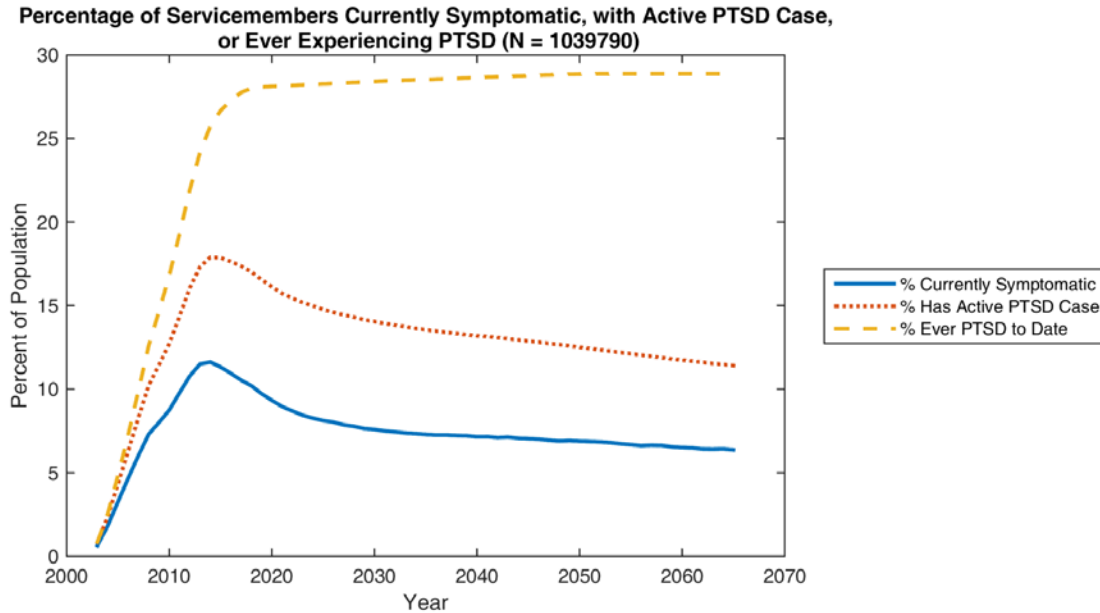
Figure 1. Baseline (best-case) model-predicted PTSD prevalence by year, using three measures of PTSD: 1) servicemembers currently symptomatic for PTSD, 2) servicemembers with an active PTSD case (those currently symptomatic plus those temporarily asymptomatic), and 3) servicemembers who have ever experienced PTSD through the indicated year end. Percentage denominator is equal to the number of servicemembers who have ever been deployed through the indicated year.

Path to Health

Figure 2 describes the composition of the PTSD population in terms of "current state" in each year. The current state describes the individual's symptomatology, symptom recognition and care-seeking behavior, i.e. the point along the path to health in each year. Breaking out the PTSD population in this manner indicates which factors most impede servicemembers' return to health at each point in time and thus the percentage of the population that may benefit from a particular policy intervention over time. A servicemember with PTSD can be Asymptomatic, Unrecognized, Recognized, or In Treatment. Asymptomatic PTSD indicates those active PTSD cases that have had prior PTSD symptoms and may become symptomatic again in the future but are temporarily asymptomatic in the indicated year. Unrecognized PTSD indicates those currently symptomatic for PTSD who have not recognized that they have symptoms. Recognized PTSD indicates those currently symptomatic for PTSD and aware of their symptoms but not seeking treatment in the current year. Treatment indicates those entering a treatment program with PTSD in the current year.

From 2009 onward, the baseline model predicts that 20-40% of the PTSD population have an active but asymptomatic case. This finding suggests that many more active cases may exist than indicated by an empirical study or screen focused on current symptomatology (as

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many as 1.25-1.6x the currently symptomatic population), especially long after the war. In years with a high percentage of Asymptomatic PTSD, a screening tool targeted at identifying current symptomatology would miss this significant percentage of the population. Around these years, continued monitoring programs may be effective, as individuals with latent PTSD cases may show symptoms in the near term. Finally, the low percentage of "Unrecognized" PTSD and high rate of "Recognized" PTSD over the long term suggests that most of those with PTSD eventually recognize their condition but do not actively seek care. Therefore over the long term, policies to encourage care-seeking are likely to impact a greater percentage of the PTSD population than would programs to screen for current symptomatology.
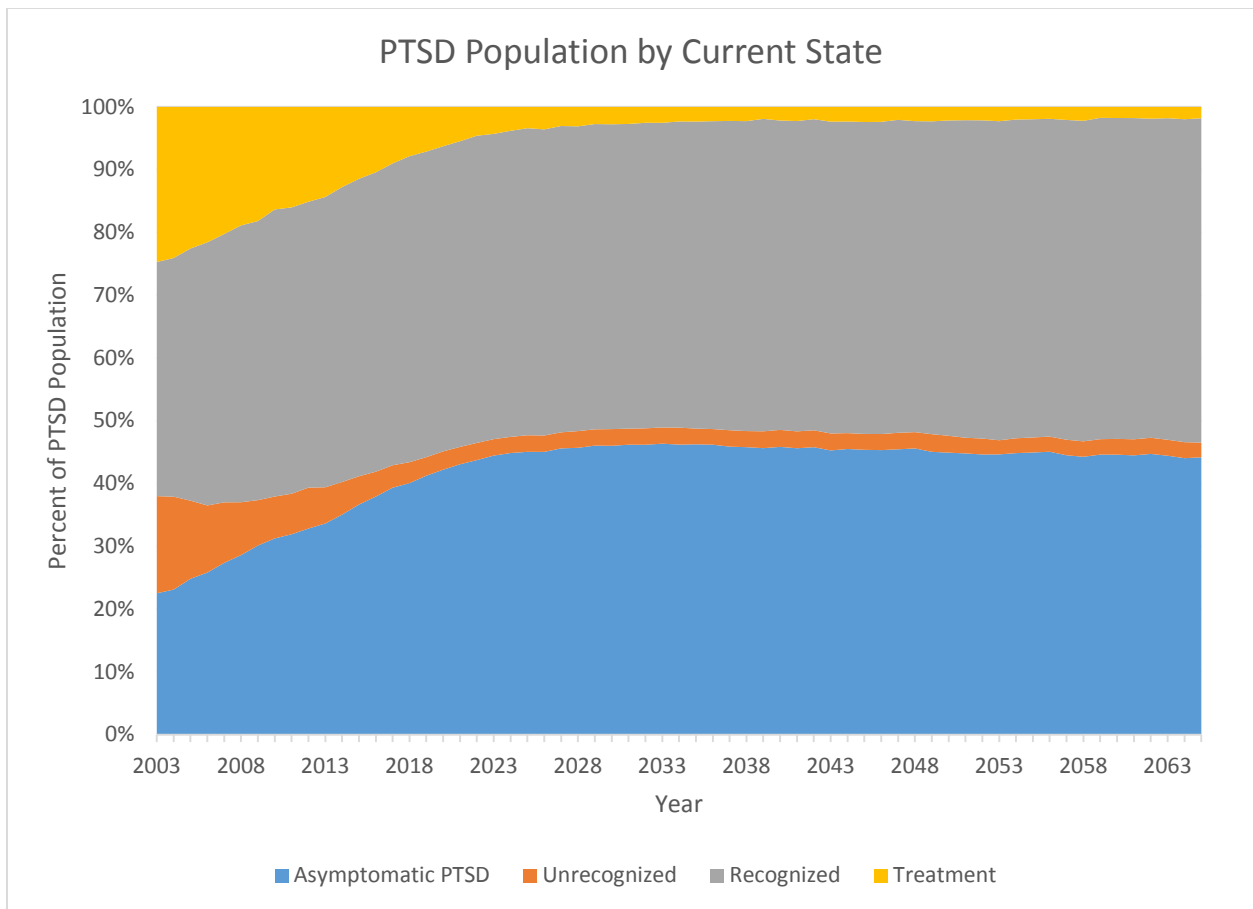

Figure 2. Active PTSD Population by Current PTSD State under the best-case model. Percentage is expressed with respect to servicemembers with an active case of PTSD in each indicated year. Asymptomatic PTSD indicates those active cases that have had prior PTSD symptoms and may become symptomatic again in the future but are temporarily asymptomatic. Unrecognized PTSD indicates those currently symptomatic for PTSD who have not recognized their symptoms. Recognized PTSD indicates those currently symptomatic for PTSD and aware of their symptoms but not seeking treatment. Treatment indicates those entering a treatment program with PTSD in the current year.

Care-Seeking and Treatment

A decreasing percentage of the PTSD population enters treatment in each period in the absence of policies to encourage care-seeking, even among individuals who never improve. Figure 3 shows the number and percentage of those with current PTSD symptoms in each period who have never received treatment to date in the baseline model. The model predicts that in the long-term, 30% of those with PTSD symptoms in an indicated year had never been treated through that year.
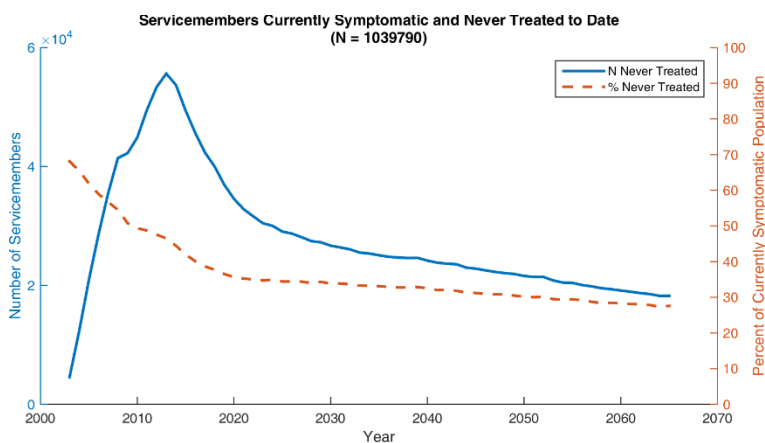

Figure 3. Number and percentage of currently symptomatic servicemembers who have never been treated to date under the best-case model.

The majority of those who ever experience PTSD—and a considerable portion of the population—will seek care at least once in their lifetime. As many as 80% of those who ever experience PTSD (23% of the population) will pursue PTSD-related health care at least once in their lives under baseline model assumptions. Even for those who undergo care, the majority of treatments are unsuccessful, and many servicemembers and veterans are unlikely to pursue subsequent episodes of care. This finding implies that an individual will likely need multiple episodes of care to fully remit PTSD symptoms over their lives.

In many cases, those with PTSD choose to wait a considerable amount of time to be treated. Under best-case assumptions, only 31% of the ever-treated population (25% of the ever-PTSD population) pursues treatment in the first year of PTSD onset. Policies that encourage care-seeking may be particularly effective at reducing this delay.

The post-deployment onset and care-seeking dynamics described by the model can help indicate how clinical demand will change over time for a particular deploying cohort. Figure 4

shows the number of years after first deployment that an individual first enters treatment. In particular, 59% of treated servicemembers do not receive their first treatment session until more than 5 years after their first deployment. This delay occurs for three primary reasons: 1) because the individual may be redeployed and develop PTSD as a result of a subsequent deployment, 2) as a result of delayed PTSD onset, and 3) as a result of delayed or repeated care-seeking. The OEF/OIF PTSD population is expected to continue to demand treatment long after the end of OEF/OIF. Servicemembers may go a considerable amount of time before they first demand PTSD care, which may be due to delayed initial onset, recognition or care-seeking. The baseline, best-case model predicts that 26% of new episodes of care occur 20 years or more after a servicemember's first deployment. Similarly, under the best-case model, only 34% of episodes of care are successful. Therefore, servicemembers are expected to continue to seek care long after the conflict's end.
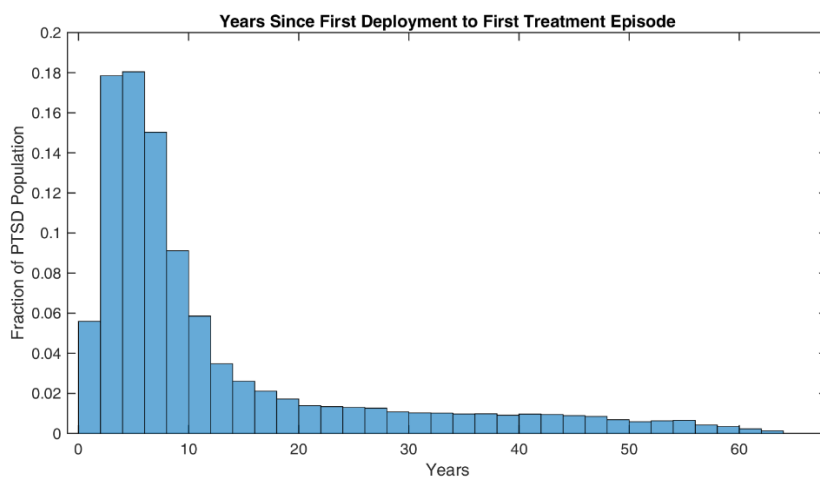

Figure 4. The number of years since a servicemember's first deployment to their first episode of care under the best-case model, in terms of fraction of the treated population.

3.2 Alternative Model Results

Figures 5a and 5b demonstrate how PTSD prevalence and clinical demand differ with respect to the alternative model specifications outlined in Table 1.

In particular, Realistic Care-Seeking and Treatment factors have a significant, adverse effect on PTSD prevalence. These assumptions reflect the realities posed by largely non-EBT treatment in clinic and resource constraints that decrease treatment quality and increase dropout. Currently symptomatic rates double under poor treatment conditions and remain elevated throughout the length of the study. The addition of realistic recognition factors marginally

worsen long-term PTSD rates as compared to the considerable effect of realistic care-seeking and treatment. Outcomes are worse in the realistic treatment models relative to the baseline model and treatment usage is low among those who need care.

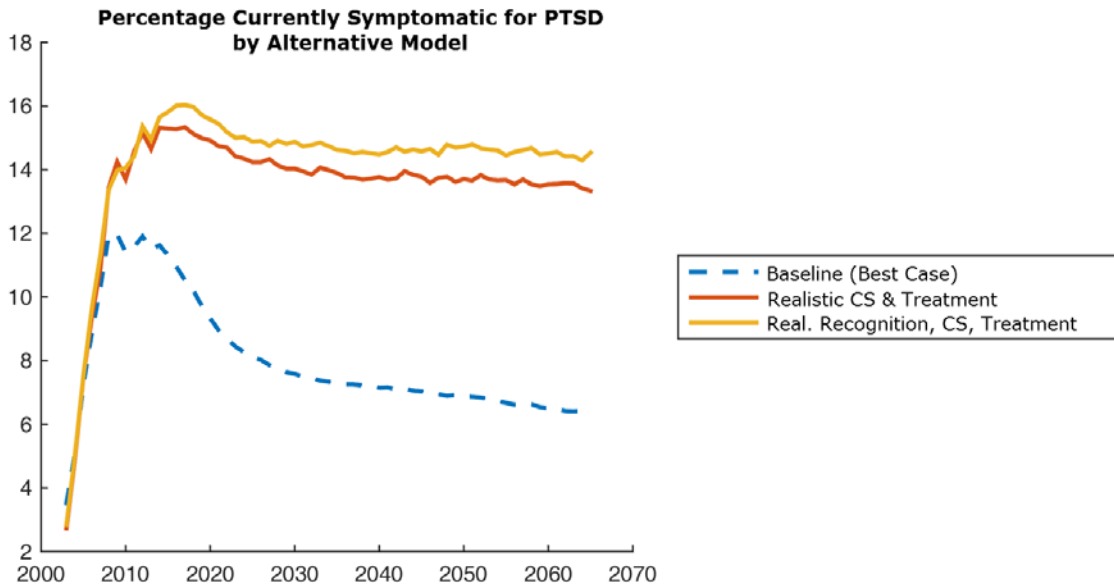**Percentage Currently Symptomatic for PTSD by Alternative Model**

Figure 5a. The currently symptomatic rate with respect to the baseline and two alternative models: 1) Realistic Care-Seeking (CS) & Treatment and 2) Realistic Recognition, Care-Seeking & Treatment (details in Appendix). Alternative model specifications represent specific changes in parameter values from the baseline, best-case model in order to reflect the lower quality conditions often seen in practice.

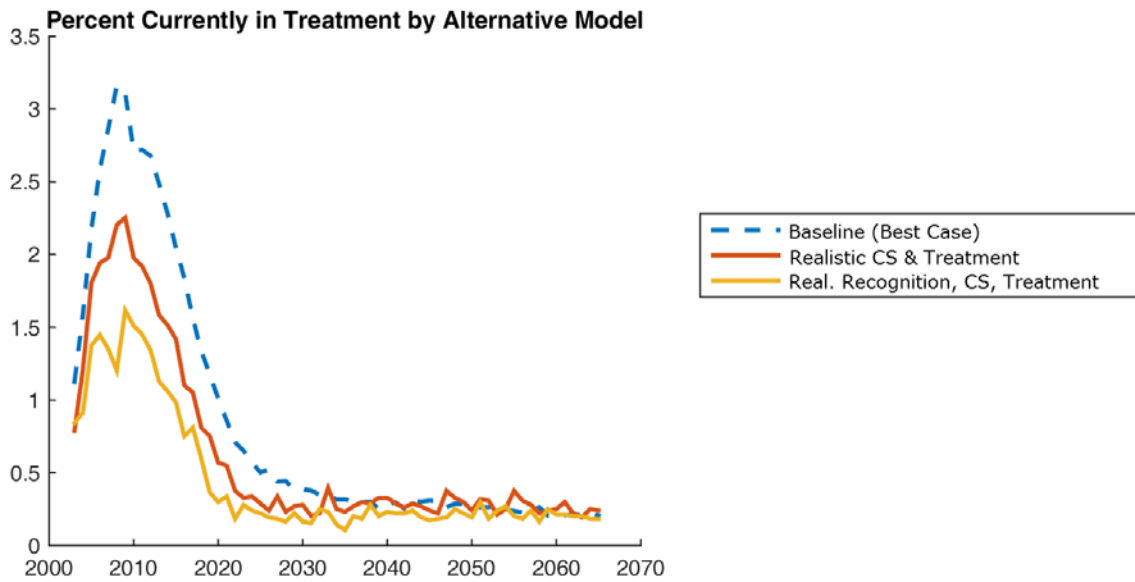**Percent Currently in Treatment by Alternative Model**

Figure 5b. The treatment entrance rate by year with respect to the baseline and two alternative models: 1) Realistic Care-Seeking (CS) & Treatment and 2) Realistic Recognition, Care-Seeking & Treatment (details in Appendix). Alternative model

3.3 Policy Analysis

Finally, policy analysis was conducted to demonstrate how the model can predict the effect of targeted changes from the status quo on PTSD prevalence and clinical usage and help identify why certain policies may be more or less effective than intended. While policies are often framed in terms of their direct effect on the lever of change, this study demonstrates that framing policy interventions in terms of universal metrics such as population prevalence in addition to the direct metric allows for possible benefits to be compared across policies that target different mitigation factors.

Three sample policies are presented to demonstrate how the timing and magnitude of the policy change impact prevalence and clinical usage outcomes (Table 3). Policies may take varying amounts of time and investment to realize the intended effect, and this model provides one way by which to assess tradeoffs[7]. The sample policies indicate unexpected consequences of policy changes in these domains, though a sophisticated analysis is needed to predict the effects of an actual, detailed policy proposal.

The complex dynamics demonstrated by the model suggest challenges for real world policy analysis. Even in the absence of policy intervention, the model predicts that factors such as prevalence and clinical demand will change by varying amounts from one year to the next. The efficacy of a policy intervention, then, is measured by the extent to which it causes a deviation in the predicted trajectory of the metric of interest, rather than simply whether its value increases or decreases after the intervention. Therefore, to gauge the effect of a policy action, analysts should compare the observed result with a model-predicted status quo result without the intervention.

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[7] Policy interventions should also be assessed by relevant qualitative metrics that the model may not be equipped to address. In particular, the groups that stand to benefit from each type of intervention have different characteristics, and there may be non-quantifiable reasons to implement a particular policy beyond its direct effect on prevalence rates. These tradeoffs must ultimately be weighed by the policymakers responsible for fund allocation.

Policy Name	Year of Change	Details	Relative Cost
Care-Seeking Education	2016	Represents investment in an education program that describes options for care and encourages its pursuit, resulting in a permanent change in the probability of care-seeking.	$
Treatment Research	2020	Represents investment in a research program to improve available treatment modalities. Though such a decision may be taken in 2016, the time to develop, test and disseminate the treatment improvements to clinicians delays the program's effect to 2020. The hypothetical new treatment improves treatment efficacy and decreases the probability of PTSD recurrence post-treatment considerably, but at high research cost.	$$$
Clinical Follow-up	2016	Represents clinical resource investment in improving follow-up with PTSD patients. The probability of treatment dropout decreases and the probability of care-seeking for follow-on sessions increases permanently among the treated population. This policy may be costly if follow-up is to occur without adversely impacting the clinic's capacity to accommodate new patients, and it may require hiring new mental health clinicians with military PTSD training.	$$
All of the Above	As above.	All of the above policies are implemented at their respective times.	$$$$

Table 3. Sample policy alternatives tested in the current study, specified in terms of the parameter changes and relative costs they comprise.

Figure 6 shows the currently symptomatic rate across the sample policy alternatives. In particular, treatment education was most effective by far at mitigating PTSD symptoms. However, this effect relies on a high clinical capacity, as demand for treatment spikes to 7% of the population in the year of policy implementation. In practice, this demand spike could result in poorer treatment because of overtaxed clinical resources and/or low repeat care-seeking among patients who are turned away or receive substandard treatment. Otherwise, treatment entrance rates are largely similar across policies. The Clinical Follow-up policy is slightly more effective than the Treatment Research policy, following the intuition that successful treatment is likely to occur eventually so long as clinicians are able to spend enough time and follow up indefinitely with patients. This effect may be tempered in reality among complex cases.
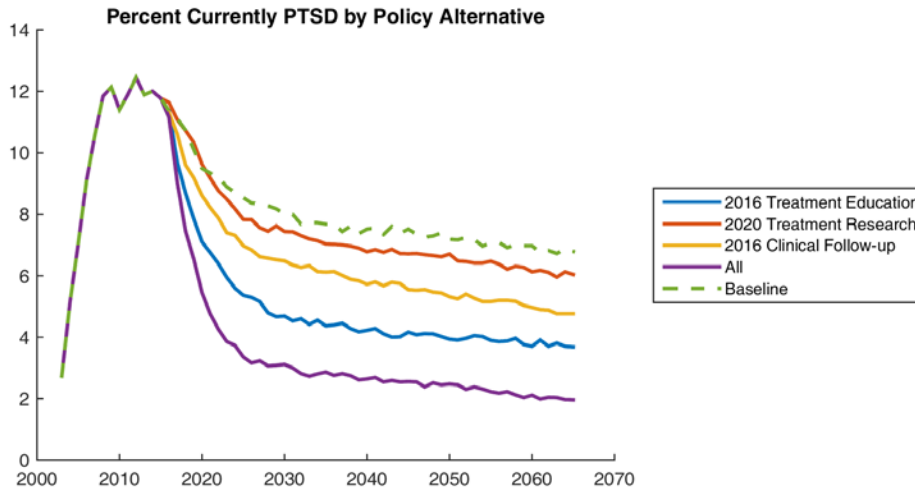
Figure 6. The currently symptomatic rate with respect to four different policy alternatives and the baseline model. Policies represent specific changes in parameter values (outlined in Table 4) beginning in the indicated year. Currently symptomatic rates are identical to the baseline model rate until the year in which the policy change is implemented.

These implications are particular to the best-case, baseline model. Under other models, the same policy interventions may cause different results because of their interactions with the other model parameters. For example, under the Realistic Recognition, Care-Seeking and Treatment model, no one parameter alone has a significant effect on outcomes. Thus under multiple system constraints, no single-domain, "silver bullet" intervention will suffice to ameliorate the PTSD burden. For policies to be effective in reducing the PTSD burden, they must represent a concerted, multi-dimensional approach across the mental health system to jointly improve the factors that mitigate PTSD.

Conclusions

The current study presents a novel long-term, dynamic model of PTSD prevalence and clinical usage. This model demonstrates how empirically observed rates of PTSD onset, care-seeking and treatment efficacy impact PTSD population prevalence over time and how uncertainty in these factors propagate to uncertainty in prevalence and clinical usage. The model also provides a low-cost, no-risk framework for testing policies to mitigate the PTSD burden before implementation, which can help policymakers understand the long-term effects of potential decisions and their interactions across domains.

This research frames the PTSD burden as a complex system. It incorporates the patterns of symptom dynamics that naturally occur among individuals with PTSD and various decisional

factors from across the mental health system. The model predicts the joint effect of these psychological and social factors on macro-level outcomes, such as PTSD prevalence and clinical usage, that are ultimately of primary interest to policymakers, servicemembers and veterans, and the general public. The system simulation approach provides a unique view of military mental health policy that may elucidate new policy solutions, though there may be qualitative reasons to prioritize certain outcomes or options in practice that a quantitative approach cannot capture.

Though this study specifically addresses OEF/OIF combat-related PTSD, the systems approach presented here may be generalized to other populations and mental health concerns. In particular, systems analyses of conditions such as substance abuse, depression and anxiety, as well as Vietnam and Gulf War-related PTSD, could complement the present study to provide a more complete picture of DoD and VA mental health workload.

This study suggests that simulation and systems analysis may offer surprising and beneficial insight that could improve how researchers and policymakers understand and provide for the long-term mental wellness of servicemembers and veterans.

Appendix

Literature Review

2.1 What is PTSD?

PTSD is a mental health disorder marked by an extended, maladaptive response to trauma. PTSD is one of many psychological effects and disorders that can be brought on by trauma, but it is the only disorder for which traumatic exposure is required for diagnosis.

Posttraumatic Stress Symptoms (PTSS) are typically considered adaptive coping mechanisms during the traumatic experience, though they are dysfunctional in everyday situations. PTSD is therefore often framed as a disorderly "failure to recover," in which the individual maintains a stress response to the traumatic memory even after being removed from the traumatic situation to an objectively safe environment (Solomon, 1993).

Trauma can cause complex mental health responses that differ in time and across individuals. Combat veterans also may experience other adverse psychological effects as a result of trauma with or without PTSD, including formal disorders such as depression and other psychological conditions such as guilt and shame. They may experience positive effects such as Post-Traumatic Growth (PTG)[8] or no notable sequelae at all (Tedeschi & Calhoun, 2004; Fontana & Rosenheck, 1998). The degree of posttraumatic response may differ from individual to individual, even among similar individuals experiencing the same event (NCD, 2009).

Combat veterans may experience subclinical PTSD, in which the individual experiences a number of PTSD symptoms but not enough to be formally diagnosed with PTSD. Subclinical PTSD may be experienced by as many as 14% of the population in addition to the full-PTSD population (Schnurr, et al., 2003). For the purposes of this study, those with subclinical PTSD are considered asymptomatic, though in practice they may experience adverse posttraumatic effects.

Widely accepted empirical studies have reported a current PTSD prevalence of 12-17% among OEF/OIF servicemembers, and the VA recently reported a 31.5% ever-diagnosed rate of PTSD among OEF/OIF veterans treated in VA facilities (VA, 2015; Hoge, et al., 2004; Schnell

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[8] Psychological benefits and liabilities from trauma are not mutually exclusive. Individuals may experience various psychological benefits from trauma, such as PTG, even if they also experience PTSD symptoms (Fontana & Rosenheck, 1998).

& Marshall, 2008; Milliken, et al., 2007; cf. Sundin, et al., 2010). Because of the broad differences in the populations they study and methods they employ, empirical studies may not be directly comparable, limiting their use predicting the risks of long term prevalence among new populations. This limitation may complicate policymakers' decisions among alternative policies to address future risks and clinical resource demands.

2.2 PTSD Symptomatology

The timing of psychological response to trauma is complex. Many who experience an acute response will not develop PTSD. Similarly, many of those who do not express an early traumatic response will go on to express PTSD in the years following conflict, or delayed onset PTSD even decades later (Horesh et al., 2011; Solomon & Mikulincer, 2006). Those with PTSD often do not express symptoms at all times. The presence and frequency of symptoms an individual expresses may wax and wane over the course of years (NCD, 2009; Schnurr et al., 2003; Bonanno, 2004).

Considerable evidence exists to suggest that Delayed Onset symptomatology (full symptomatology first appearing years after the trauma) represents at least 6-15% of lifetime PTSD cases depending on the definition used and time of assessment (Andrews, et al., 2007).

2.3 PTSD Recognition and Care-Seeking

Compounding symptom fluctuation, observational factors further complicate policymakers' and researchers' ability to assess population PTSD prevalence and make decisions over time. An individual with PTSD may be surveyed at a time that they temporarily do not express symptoms, the diagnostic tool or clinician interview may inaccurately indicate a false negative result, or recall bias could cloud individuals' ability to remember traumatic details, compromising the accuracy of any single prevalence study or diagnosis. Stigma, lack of information, logistical barriers, and the fear of professional repercussions are the most frequent reasons why those with possible PTSD do not acknowledge mental health concerns in non-anonymized situations or seek care.

2.4 Prior Simulation Modeling

To date, there are two other known models that use simulation methods to study PTSD.

Each model must incorporate certain assumptions that enable it to describe a precise aspect of the population PTSD burden.

One existing model uses empirical rates of acute stress symptoms and PTSD to predict PTSD onset given deployment characteristics (Atkinson, Guetz & Wein, 2009). Another model, developed at RAND, assumes a fixed rate of PTSD and uses care-seeking, treatment, comorbidity and employment characteristics to estimate two year costs due to the PTSD burden (Tanielian & Jaycox, 2008).

The model developed and presented in this study uses aspects similar to each of the above studies and adds certain novel elements so that it can be used to assess long-term dynamics. Like the Atkinson, Guetz & Wein model, the present model uses deployment characteristics to replicate PTSD onset by calendar year over the course of OEF/OIF[9]. Like the RAND study, the present model uses rates of care-seeking and treatment efficacy to understand clinical usage and long-term outcomes. However, the present model also captures the trajectories of symptomatology, care-seeking and treatment success of individual servicemembers over the long term and considers prevalence dynamics and clinical demand in each year. For example, the current model allows for PTSD cases to remit as well as for symptoms to fluctuate from period to period, using empirical rates of remission and symptom density to capture how the PTSD burden changes in time.

Model Structure

The psychological and decisional processes described above, including the primary policy mechanisms, motivate the states and processes modeled in this study.

State Definitions

An individual servicemember's state is defined in each period by a vector consisting of three true/false indicators that specify whether the servicemember is 1) Symptomatic, 2) Observed and 3) In Treatment. Transitions between states from one period to the next may occur as a result of psychological processes, individual decisions, or policy interventions.

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[9]   The present study includes OEF data whereas the Atkinson, Guetz & Wein study assesses OIF outcomes only.

These three indicator variables together represent mutually exclusive and collectively exhaustive states that track each individual's PTSD status and the interventions available to elicit remission (Figure 1). While there are eight possible combinations implied by the three indicator variables, only four have substantive real-world meaning within the scope of the current study. Table 1 describes the eight possible combinations and four model states.
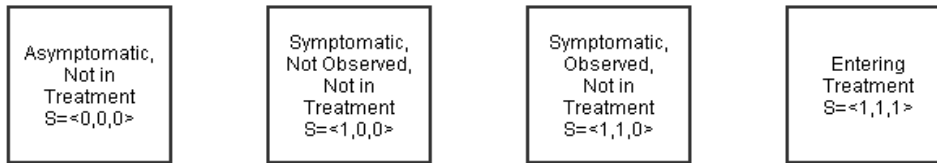

Figure 1. Mutually exclusive states used to track individuals symptomatology and care-seeking behavior in each period.

State	Symptomatic I_{PTSD}	Observed $I_{Obs.}$	In Treatment $I_{Treat.}$
Asymptomatic, Not in Treatment	False PCL < 40	False Individual is not aware of their PTSS	False Individual is not in a PTSD treatment program
Symptomatic, Not Observed, Not in Treatment	True PCL ≥ 40	False Individual is not aware of their PTSS	False Individual is not in a PTSD treatment program
Symptomatic, Observed, Not in Treatment	True PCL ≥ 40	True Individual has either screened positive for PTSD or recognized PTSS	False Individual is not in a PTSD treatment program
Entering Treatment	True PCL ≥ 40	True Individual has either screened positive for PTSD or recognized PTSS	True Individual is in a PTSD treatment program

Table 1. States' definitions with respect to underlying indicator values

			Alternate Models	
Domain	Model Parameter	Baseline Value	Realistic CS &Treatment	Realistic CS, Treatment and Observation
Observation	Observation Prob.	0.78	-	0.5
	Year on Year Observation Prob. Ratio	0.75	-	0.5
Care-Seeking	Treatment Entrance Prob.	0.40	0.35	0.35
	Year on Year Treatment Prob. Ratio	0.75	0.5	0.5
Treatment	Treatment Efficacy	0.55	0.39	0.39

Prob. Of Relapse Post-Treatment	0.25	0.40	0.40
Dropout Probability	0.25	0.48	0.48

Table 2. Baseline and alternate model parameters. A '-' specifies that the parameter value is unchanged from the baseline model.

Figures 2a and 2b depict the deployment and PTSD onset mechanisms used in the Longitudinal Model to determine which servicemembers develop PTSD and when.
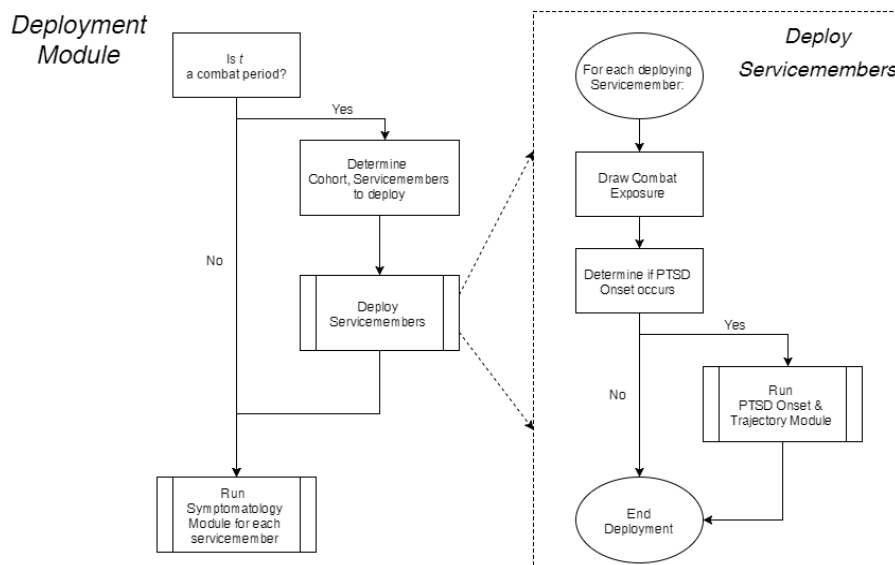

Figure 2a. The Deployment Module algorithm, run in each model period, t. *The Deployment Module determines which servicemembers will deploy in a combat period, assigns combat exposure, and determines whether each deploying servicemember will develop expected PTSD as a result of the deployment. The Deployment Module is passed through in non-combat period. The Symptomatology Module is presented in Figure 10a.*
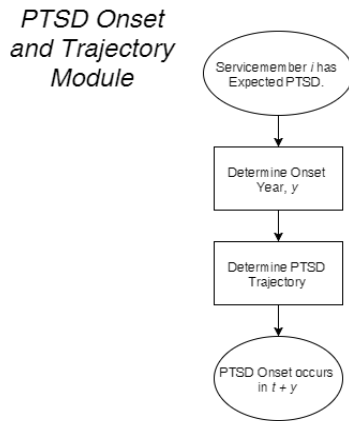
Figure 2b. The PTSD Onset and Trajectory Module algorithm, run for each servicemember with expected PTSD. The PTSD Onset and Trajectory Module determines the onset year and symptom trajectory for an individual with expected PTSD. The expected PTSD case may occur as a result of combat or if PTSD recurs after treatment.

Deployment

The model simulates Army and Marines deployments over the 2003-2014 OEF/OIF period. Precise deployment data is unavailable, therefore the model uses quarterly data on the total number of troops deployed and average troop rotation rates to estimate the number of newly deploying troops and to select the simulated servicemembers that are deployed each quarter.

The timing, duration and severity of a servicemember's combat exposure impact the probability of PTSD onset. Each servicemember is assigned a random combat severity for each deployment based on the reported intensity of combat at that time and the servicemember's deployment duration.

PTSD Probability

In each deployment, the servicemember risks developing a PTSD case as a result of combat trauma. The Longitudinal Model first determines whether the individual will or will not develop a PTSD case as a result of the deployment. If so, the individual is said to have Expected PTSD and the model then determines the year in which symptoms will first occur and the type of PTSD case the individual will experience. PTSD risk increases with respect to combat exposure level (Koenen, et al. 2003; MHAT-V, 2008).

Time to PTSD Onset

The time at which PTSD symptoms first present after the trauma differs across cases. In

many cases, PTSD symptoms present soon after the trauma. In other cases, however, PTSD symptom onset occurs years after the individual has returned from combat. In the model, if an individual has Expected PTSD as a result of a particular deployment, the time to onset is then calculated, and the individual becomes symptomatic in the assigned period.

PTSD Trajectory

Individuals with PTSD differ in the timing and frequency with which they express symptoms. Symptoms may not present at all times, even among chronic PTSD cases, and individuals may fluctuate between symptomatic and asymptomatic periods. When a servicemember is determined to have Expected PTSD, they are assigned one of four PTSD Trajectories that correspond to clusters identified by Schnurr, et al (2003) among Vietnam War veterans. The servicemember's PTSD Trajectory determines the frequency of their future symptoms. The four PTSD Trajectories and their behavior within the Longitudinal Model are defined as follows:

>   *Remitting*: Individuals with remitting PTSD express PTSD for an average of 8 years before symptoms spontaneously remit and the individual permanently improves (Schnurr, et al., 2003).

>   *Chronic, Intermittent:* The chronic, intermittent PTSD cluster first expresses PTSD not long after trauma. However, this group is not likely to spontaneously remit symptoms and will experience occasional, but disordered, symptoms indefinitely. The chronic, intermittent cluster expresses full PTSD symptoms one quarter of the time.

>   *Chronic, Unremitting*: The chronic, unremitting PTSD cluster also first expresses PTSD early after trauma.. Unlike the intermittent group, the chronic, unremitting group experiences debilitating symptoms most of the time, indefinitely.

>   *Delayed Onset:* The delayed onset PTSD cluster first expresses symptoms much later after trauma. This group may indeed be healthy for a number of years upon return from combat, only developing PTSD after a life change causes the individual to reappraise the traumatic event years later. Average symptom density in this group is slightly lower, at 85%, such that they experience full symptomatology relatively often and indefinitely, once onset occurs.

Observation

For an individual to pursue treatment or disability compensation, they must first be observed with a possible PTSD case. Observation can occur one of two ways: via a formal screen or informal, episodic recognition of possible PTSS. In the model, episodic recognition occurs in each period with a probability related to the empirically observed rate of mental health concern recognition (Hoge, et al., 2004). A formal screen occurs in a pre-specified period, and all simulated servicemembers exhibiting symptoms in that period are recognized with probable PTSD with a probability equal to the true positive rate of the screening tool.

Care-Seeking

Once the individual recognizes their possible PTSD, they may enter treatment. Entrance into treatment depends on both the individual's decision to seek care and the availability of clinical resources to provide treatment. Following the convention in empirical studies, treatment is considered successful if it abates PTSD symptoms to a subclinical level. Successful treatment may not abate symptoms permanently, such that successfully treated PTSD cases recur at a later date with some probability.

Treatment Effect

An individual in treatment either completes the program or drops out mid-course. The base case probability of drop-out is taken from a recent treatment usage study (Hoge, et al., 2014). In dropout cases, treatment is considered unsuccessful and the individual remains symptomatic.

Conditional on completion of the treatment, the program may or may not be successful in abating the individual's symptoms to a sub-clinical level, and this symptom decrease may or may not be persistent. Actual PTSD treatments differ greatly in terms of efficacy of remitting symptoms and persistence of this effect. The base case model assumes the use of Prolonged Exposure (PE) therapy, which is one of two so called evidence-based treatments (EBT) that the VA has mandated be made available to any veteran for whom an EBT is clinically appropriate[10]. The probability of treatment success using PE is 55% (Eftekhari, et al., 2013; Tanielian & Jaycox, 2008).

[10]   Per VA Handbook 1160.05, 2012.

Successful treatment may abate symptoms either temporarily or permanently. Treatment persistence refers to the length of time following successful treatment that the treated individual remains asymptomatic. Data on treatment persistence is limited, but it is assumed that 25-55% of PTSD cases successfully treated with EBTs will recur in the future (Tanielian & Jaycox, 2008).

The model assumes that the treatment program lasts only one period in order to provide a conservative clinical workload estimate. In practice, a chronic PTSD case may remain in long-term treatment indefinitely in order to manage symptoms.

The individual's experience in the treatment program may impact their future willingness to pursue care in the event of future PTSD symptoms. A recent RAND study shows that 74% of veterans who have undergone a treatment program considered the experience somewhat helpful or helpful (Watkins, et al., 2011). The base case model assumes this rate as a proxy for likelihood to pursue treatment again in the event of future symptoms.

The flow charts describing the Symptomatology and Treatment Module algorithms are presented in Figures 3a and 3b. These algorithms determine each servicemember's state in each period.
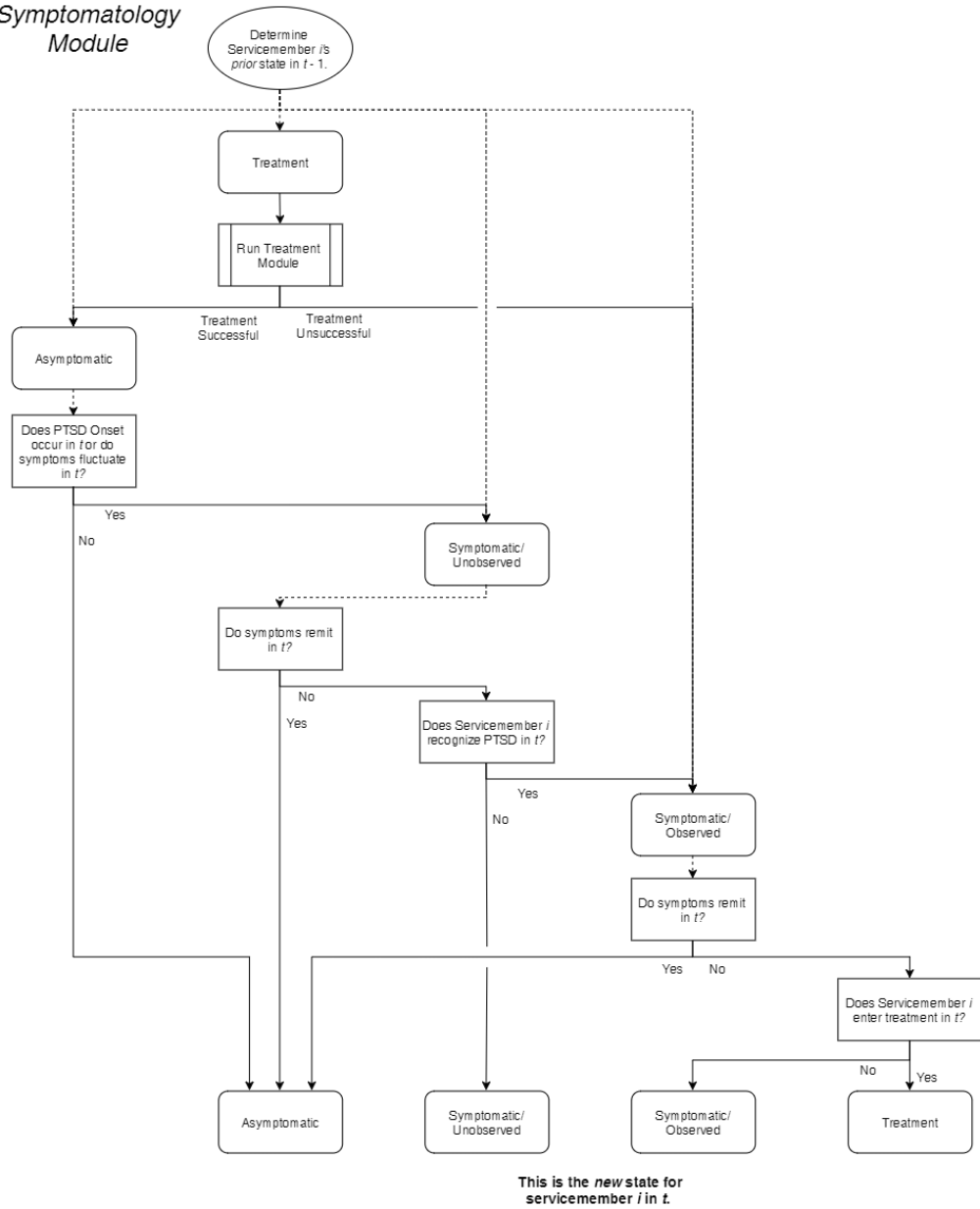
Figure 3a. The Symptomatology Module, run in each period for each servicemember. The Symptomatology Module determines whether servicemember i *will develop or remit PTSD symptoms in period* t, *and, if symptomatic, whether PTSD recognition or treatment will occur.*
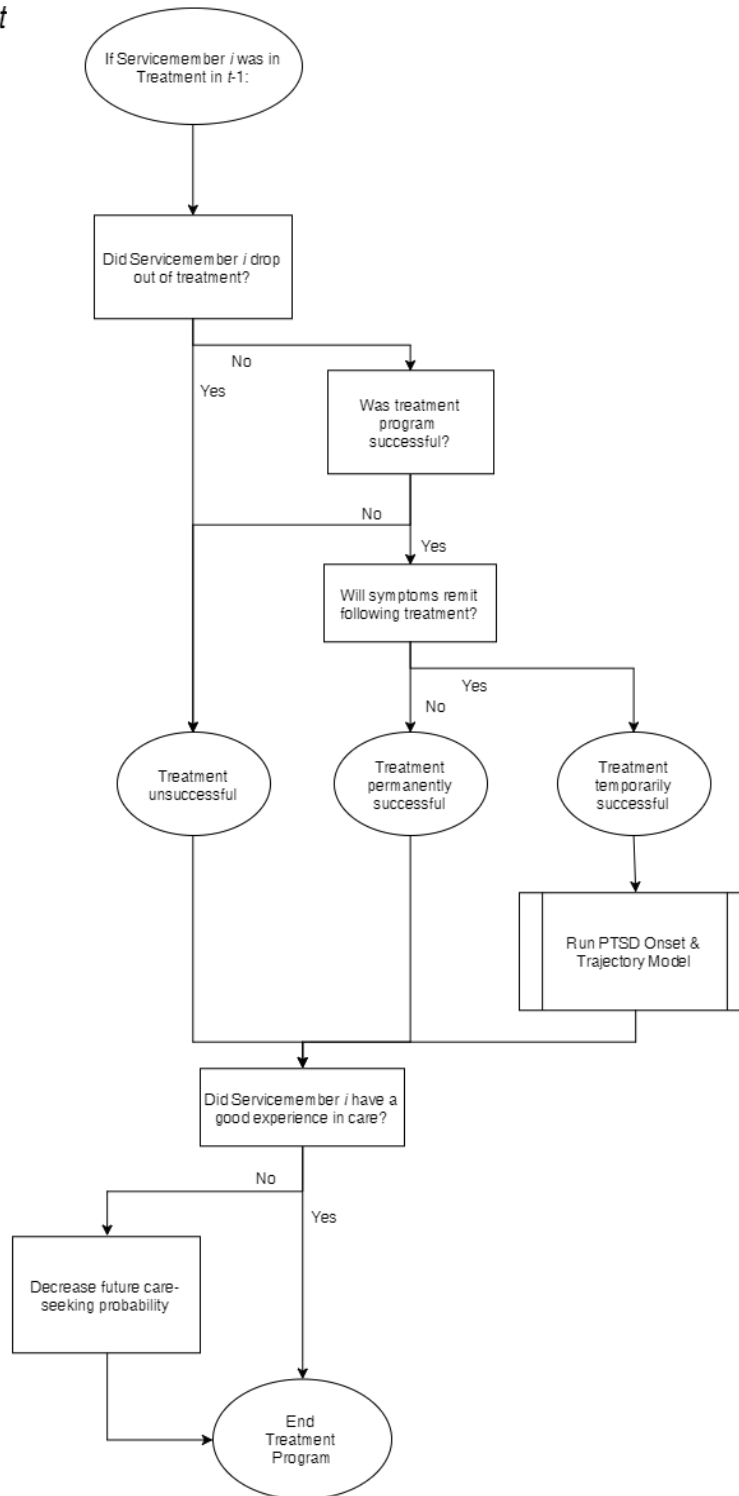
Figure 3b. The Treatment Module algorithm, run for servicemember i *in the period following treatment. This Module determines whether treatment was successful in remitting symptoms, whether a new PTSD case will occur following temporarily successful treatment, and whether the individual's experience in treatment will impact their future care-seeking behavior.*

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