

Performance Dynamics In Military Behavioral Health Clinics

by

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Submitted to the System Design and Management Program
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Abstract

The prevalence of Post Traumatic Stress Disorder (PTSD) and other related behavioral health conditions among active duty service members and their families has grown over 100% in the past six years and are now estimated to afflict 18% of the total military force. A 2007 DoD task force on mental health concluded that the current military psychological health care system is insufficient to meet the needs of the served population. In spite of billions of dollars committed to hundreds of programs and improvement initiatives since then, the system continues to experience provider shortages, surging costs, poor access to and quality of care as well as persistently high service-related suicide rates.

We developed a model to study how the resourcing policies and incentive structures interact with the operations of military behavioral health clinics and contribute to their ability to provide effective care. We show that policies and incentives skewed towards increased patient loads and improvement in access to initial care result in a number of vicious cycles that reinforce provider shortages, increase costs and decrease access to care. Additionally we argue that insufficient informational feedback contributes to incorrect attributions and the persistence of ineffective policies. Finally we propose a set of policies and enabling performance metrics that can contribute to sustained improvement in system performance by turning death spirals into virtuous cycles leading to higher provider and patient satisfaction, better quality of care and more efficient resource utilization contributing to better healthcare outcomes and increased levels of medical readiness.

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1 Introduction

Since 2001, more than 1.8 million US troops have been involved in Operation Enduring Freedom (Afghanistan) and or Operation Iraqi Freedom (Iraq). Most of the service members return from deployment with no major visible health problems. However many of them may be suffering from mental illness. Research based on empirical studies showed that over 26% of returning troops may have mental health condition. The most common types of behavioral health condition include Post Traumatic Stress Disorder (PTSD), anxiety disorder and major depressive disorder. The prevalence of PTSD among active duty service members has been estimated to be 18%, while anxiety disorder and major depression account for 15% and 18% respectively. [1] In 2007 the Department of Defense (DoD) task force on mental health concluded that the military psychological health care system is insufficient to effectively meet behavioral health needs of the military population. [2] Congress responded by committing billions of dollars into various programs across DoD and Veterans Administration (VA) with a mandate to improve treatment for those that were wounded in action.

However in spite of these efforts many challenges remain including persistent provider shortage at behavioral health clinics, inadequate access to care, surging costs and consistently low remission rates. Although reluctance to seek care by service members with behavioral health needs is noted as a significant obstacle to maximizing military force readiness, number of behavioral health encounters has been growing exponentially in the past several years. Increased demand exacerbated provider shortage and contributed to inadequate access to care. Mental healthcare costs also experienced a rapid growth driven by surging number of enrollees and an increase in the number of yearly behavioral health encounters per patient. [3] Respect-Mil (Re-engineering

Systems of Primary Care Treatment in the Military), which use primary care settings to screen, diagnose and refer patients with behavioral health conditions to specialists is are only programs that track behavioral health specific outcome measures. Based on their data over the past two years remission rates stayed relatively flat between 10 and 20%.

To combat surging costs and to demonstrate efficient resource utilization, US Military Medical Command institutionalized a set of policies to allocate behavioral health assets in a way that maximizes access to care and minimizes unwarranted cost variation. There are two system capacity levers at the disposal of behavioral health clinic management. One is based on the productivity requirements of providers and allocation of their time between new and follow up appointments. The other involves decisions and processes of hiring, credentialing and training of new providers. These policies along with compensation and performance assessment of providers form the incentive structures in the clinics and impact their behavior and ability to provide quality care.

Researchers have long agreed on importance of human resource management (HRM) policies and practices in determination of both employee and organization level performance. [4, 5] However after two decades of empirical based research studying the relationship between human resource management and performance no consensus is reached on the nature of this relationship. Although there are well-established models linking HRM to performance through the impact on employee attitudes and behavior, very few studies explore the causal chain linking employee behavior to their productivity and work quality and subsequently how it impacts organizational performance. [6]

In this thesis we present a model that can be used to capture the impact of resourcing policies and incentive structures on the performance of behavioral health clinics, focusing on the quality of care

death spiral and how it can be mitigated and reversed. This work builds on previous studies in knowledge based services [7] extending it to include healthcare specific patient flow dynamics. We use causal loop diagramming [8] to explore the key feedback loops contributing to performance of military behavioral health clinics along three main dimensions: access to care, cost and outcomes. We then present a system dynamics model that tracks the flow of patients through the system of care and captures the impact of resourcing decisions and incentive structures on the performance of behavioral health clinics. Finally we present key findings that we believe help answer the question of why the efforts to improve effectiveness of care have been unsuccessful.

The rest of the thesis is structured as follows. We first present the major resourcing policies and incentive structures operating in the clinics. We then go over intended performance outcomes driven by the resourcing policies. Next, we expand the analysis to include the unintended consequences of the current resourcing policies, which go largely unseen by the clinics leadership. We then present a case for the need of a quantitative model that captures the impact of these important dynamics on medical readiness of active duty service members. The final three sections focus on model results, limitations, recommendations and future work.

2 Literature Review

Ever since the seminal Institute of Medicine's Quality of Chasm report: Crossing The Quality Chasm [9] and subsequent report, Improving the Quality of Health Care for Mental and Substance Use Conditions [10] were published, there has been a wide adoption of recommendations designed to improve the performance of mental health care systems. The reports concluded that current

healthcare systems are inadequate to meet population healthcare needs and should be re-designed in order to improve performance across the following six aims: patient safety, treatment effectiveness, patient centered care, timeliness, efficiency and equity.

The performance dimensions most commonly used to measure hospital performance are financial, operational, quality, customer and employee satisfaction. However little empirical evidence of hospitals adopting multi-dimensional performance measurement exists. [11] Moreover very little research has been done to study relationships among key performance dimensions and various elements of organizational design. [12]

In the business policy and strategic management literature there are two main streams of research: the one that attributes firm performance to external market factors, and another, which sees organizational factors and their fit to the external environment as a major determinant of firm success. Empirical research shows that internal organizational factors explain significantly more variation in firm's profits. [13] The resource-based view (RBV) of organizations emerged in the late 50's [14], articulated in late 80's [15] and since then has become one of the most influential frameworks for understanding strategic management. [16] RBV shifted the focus of strategy literature away from external factors and towards internal firm resources as sources of competitive advantage. [17] RBV also played an integral role in development of strategic human resource management (SHRM) literature devoted to exploring the link between human resource policies and firms' business strategy and performance. [18]

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In healthcare organizations there are three main resources: workforce, equipment and facilities. Health care workforce represents a variable capacity resource and is represented by providers, nurses and other medical and administrative staff. Management policies of these resources play a central role in hospitals ability to provide quality care as well as attract and retain patients. A review of research literature on capacity management decisions in healthcare found most of it concentrated on addressing problems of resource utilization, efficiency and costs existing in inpatient facilities. However authors agree that because of a shift in healthcare towards higher demand of ambulatory health care services and capacity management with a goal of not only increasing efficiency but also providing quality of care, the next challenge is to produce actionable research that studies the impact of capacity decisions on performance that includes broader goals of healthcare organizations. [19] Effective capacity management must deal with complexities involved in tradeoffs between resource utilization and quality of care, demands from competing sources and types of patients, time-varying demand and diverse sets of perspectives and incentives of internal and external stakeholders. This complexity calls for development of new queuing and simulation models to help guide strategies and decisions. [20]

The modeling approaches most commonly used to study the link of capacity/resource management to hospital performance include linear goal programming, event based simulation and markov

models. Queuing theory has been applied extensively to healthcare organizations, but mostly focused on strategies around better utilization of resources and minimization of patient waiting times. [21-25] Simulation models tend to be more complex than queuing theory based models and offer capability to characterize a deeper breadth of factors contributing to effectiveness of health care delivery including patient scheduling and admission flows as well as allocation of resources when planning beds, rooms and staff personnel. [26] Although significant strides have been made in understanding and studying of factors contributing to prolonged patient waiting times and increasing costs, only few studies to date address dynamic complexities involved in improving public health delivery systems.

System Dynamics modeling is well suited for dealing with dynamic complexity that characterizes many public health issues. [27] It has been successfully applied to address the issue of crowding in emergency department, highlighting the impact of critical interaction between physical constraints of the system (e.g. bed availability) and behavioral factors (human capability to perform under high work pressure and time constraints). [28] However no studies have been done on modeling the flow patients through mental health system where treatment cycles are much longer than in acute care settings. This thesis aims to use system dynamics methodology to capture the impact of resourcing policies and behavioral factors on military behavioral health clinics' performance. This work builds on previous studies of in knowledge based services [7] extending it to include healthcare specific patient flow dynamics.

3 Data Sources

Data used in this thesis was derived from over two hundred interviews and seven military base visits in 2011 and 2012. The interviews were conducted with diverse sets of stakeholders including healthcare providers, military leaders, active duty service members, clinic administrators and staff. In addition to interview data, we reviewed official policy documents that described the processes followed in the clinics [29, 30] and relevant research literature based on empirically derived population level statistics [31, 32]. We were unable to gain access to patient encounter data for specific clinics, which is the main source of model limitations described in the section 5.4 of this thesis.

4 Qualitative Analysis

4.1 Resourcing Policies

The effectiveness of meeting varying demand at military behavioral health clinics is largely dependent on how well it is being matched with the capacity to provide care. There are two main resourcing policies that govern capacity management at the clinics. The most widely utilized policy is that of setting productivity requirements of providers determined by minimum patient loads and the number of daily appointments. This policy offers immediate but limited boost to the capacity of the system but carries with it a set of unintended consequences, which will be discussed in detail in the following sections.

The other policy comes into play when productivity adjustments are not sufficient to meet more permanent increases in demand. If the demand surge is temporary and is not expected to continue, clinics request temporary behavioral health assets usually in the form of contractors. For more

sustained demand increases clinics request full-time providers to be added to the workforce. Currently the Military Treatment Facility (MTF) commanders employ the Tri-Service Business Planning Tool (BPT) to project resource needs a year forward. Projections are based on past year utilization of healthcare services and an inflation factor to account for anticipated environmental changes largely associated with planned deployment cycles. In times when the actual demand turns out larger than the projected the clinics make requests for new hires as the need arises.

The hiring process involves several stages. Before a new position can be advertised it has to be approved by the higher command. The formal hiring request includes documented reports of provider workloads and the evidence of the unmet demand indicated by poor access to care measures. The percentage of patients able to receive their initial routine appointments within seven days and acute appointments within 24 hours is used to indicate capacity constraints in the clinics. Once new position is approved it gets advertised across DoD and on public job sites. Depending on the specialty of the position, filling it may take anywhere from six months to two years. Finally, when the new hire is brought on board he or she has to get certified and credentialed before being able to treat patients. Credentialing process also involves a delay of up to six months depending on the military site and the region where the clinic is located. The decision of whether to meet the demand in the clinic by adjusting productivity of providers or by hiring new ones is driven in part by the incentive structures imbedded in the system.

4.2 Incentive Structures

We characterize incentive structures in the clinics by analyzing the performance measures used in the system and how they influence the behavior of providers, clinic chiefs and patients.

Our interviews and the review of official policy documents showed that surging healthcare costs and poor access to care prompted Military Healthcare System (MHS) and Army Medicine (Army Med) leadership to focus their efforts on effective resource utilization and retention. 2012 MHS Stakeholder report declared healthcare costs inflation unsustainable attributing a large proportion of it to the provision of mental health care services. [3] Enhancing access to care is one of the main improvement initiatives going forward driven by the goal of maintaining continuity of care and “see today’s patient today”. To ensure effective resource utilization and improved access to care, Army Med leadership requires all MTFs to regularly report their performance against access to care and resource utilization standards.

US Army access to mental health care standards are the following:

- Urgent appointments will be provided within 24 hours or less
- Routine mental health care, defined as an initial request for previously undiagnosed mental condition or exacerbation of a previously diagnosed one will be provided within 7 days of the request
- *No standards exists for follow up appointments*

Performance against access to care standards show the percentage of service members able to get their initial appointment within the standards described above.

Resource utilization standards are derived from production of the relative value units (RVUs) on a provider and clinic levels. Each appointment and treatment procedure is awarded a certain number of RVUs that varies based on the duration and the complexity of treatment provided. RVUs can then be translated into dollar amounts and used to calculate reimbursements. Each provider is required

to produce a minimum number of RVUs daily, which varies, based on the specialty of the provider. The number of RVUs clinics generate demonstrates how well their resources are utilized and determines the size of the budget clinics will be able to claim in going forward.

Attention to resource utilization and access to care creates an incentive to increase productivity of providers, focus their effort on seeing more new patients and reduce treatment cycles for existing patients. Because the only performance measures that the clinics report up the chain of command regularly are access to care and RVUs, clinic chiefs are driven to maximize their performance against these measures. Providers are assessed on the sizes of their patient loads and RVUs they generate. In order to accommodate for more new patients and improve access to care, clinics are incentivized to reduce treatment cycles. To that end clinics adopted a “short term care” model, which involves only three therapy sessions compared to recommended five to seven sessions before the patients are reassessed for further treatment options.

4.3 Intended Dynamics of Resourcing Policies

The intended dynamics generated by the resourcing policies and the incentive structures described above are depicted in Figure 1, which captures three balancing feedback loops triggered by increases in demand for care.

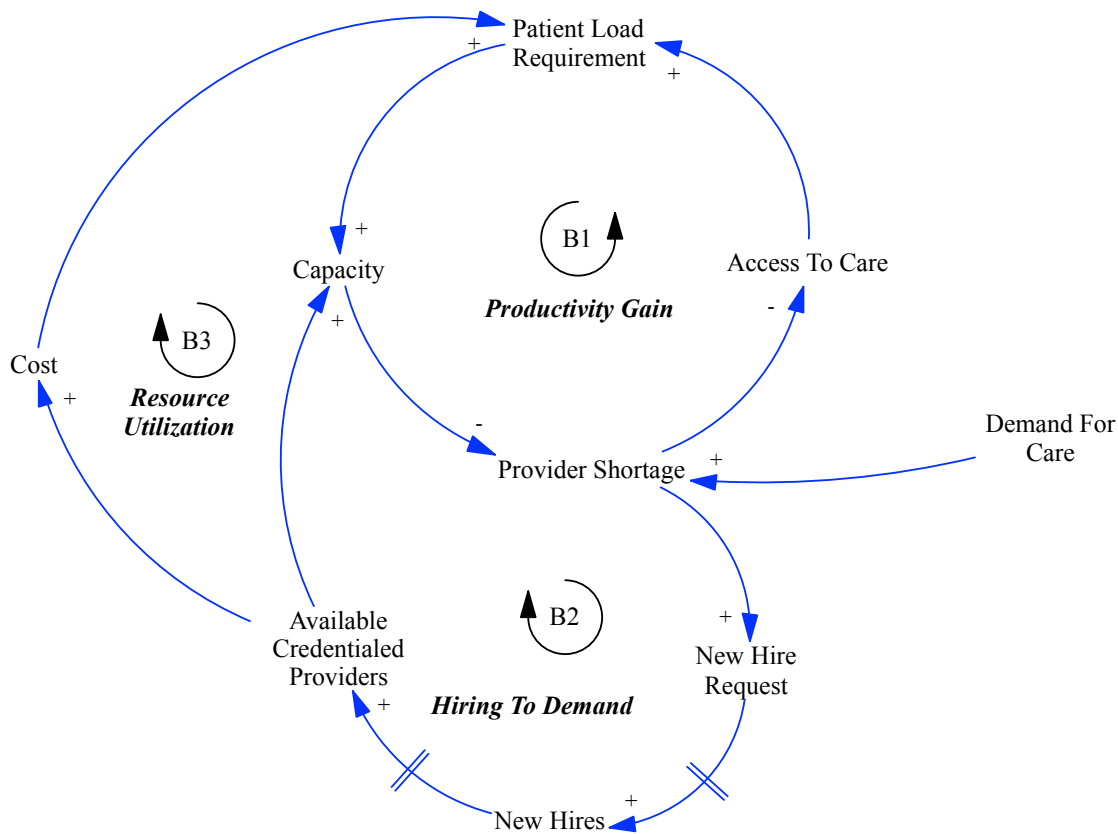


Figure 1 – Intended Performance Dynamics

B1: Productivity Gain

Our interviews have indicated that demand surges are highly correlated with the deployment cycles. However because of the difficulty involved in forecasting the sizes or the timing of demand surges and the focus on efficient resource utilization, the clinics tend to have only a small amount of capacity buffer to account for them. So when demand turns out to be larger than expected provider shortage becomes more acute resulting in the system’s inability to accommodate the inflow of service members seeking their first behavioral health appointments in a timely manner. Increased waiting times directly affect access to care measures, which are routinely tracked and reported up the chain of the command. Clinic chiefs and higher command officials pay close attention to clinics

ability to provide new appointments inside of the access to care standards. Deterioration of access to care creates pressure on clinic chiefs to increase provider productivity and patient load requirements, prompting providers to take on more new patients as their performance is assessed based on the size of their patient loads and the number of weekly appointments they provide. As providers increased their capacity to see new patients overall system capacity increases, alleviating provider shortage, improving access to care measures and completing intended balancing feedback loop.

B2: Hiring to Demand and B3: Resource Utilization

With substantial demand surges and the realization that current capacity is insufficient in spite of increased productivity requirements, clinics opt to hire new providers to fill the gap. This policy as explained earlier involves considerable delays, costs and added oversight. However once new providers are hired and credentialed, capacity of the system increases reducing acuity of provider shortage and improving access to care. Increased costs associated with hiring of new providers prompt the clinics to focus even more on resource utilization in order to justify the need for acquired resources and avoid further hiring. This creates additional pressure to keep the patient load requirements high.

4.4 Unintended Dynamics of Resourcing Policies

Unintended consequences of productivity and access to care focused incentive structures resource policies stem from their impact on the quality of care. The research literature characterizes quality of care across three broad dimensions: structure, process and outcome. [33] The structure represents the appropriateness of treatment settings including staffing, infrastructure, and

equipment. The process perspective represents the flow of patients through the clinic, interaction between patients and the hospital staff and answers the question of whether patients are receiving care in a way that conforms to evidence based practices. Finally the outcome perspective looks at the effectiveness of the care provided. Based on this classification our interviews have shown that increased provider productivity affects the process and the outcome components of care quality.

R1: Full Treatment Sacrifice

The most immediate negative impact of driving providers to see more new patients is a reduction in time available to treat existing patients. As the providers take on more new patients their schedules fill up with new appointments leaving less room for follow-up patients. A full treatment cycle usually includes a set of psychotherapy and/or pharmacotherapy sessions. The gap between each such session is determined partially by the availability of appointment slots in the providers' schedule. The VA/DoD Clinical Practice Guidelines (CPGs) call for a set of psychotherapy treatments, efficacy of which was established empirically. Compliance to CPGs calls for the time between therapy sessions to not exceed one week. [29] Access to follow-on care is determined by patients' ability to schedule timely follow up appointments. As the patient load requirements increase, the gap between therapy session increase. Deterioration in access to follow on care results in non-compliance to CPGs and potentially lower effectiveness of treatment provided. Lower treatment effectiveness contributes to longer recovery rates, which increases internal demand for care as encounters per patients increase. As a result provider shortage worsens decreasing access to initial care further and triggering a viscous cycle of increased patient load requirements, deterioration in access to follow on care and further increases in demand.

R2: Fire Fighting Effect and R3: Burnout Effect

Prolonged periods of increased productivity also trigger several other reinforcing feedback loops that result in deterioration of quality of care and subsequent increases in demand. Our interviews indicated that extensive workweeks of seeing a high number of patients result in provider burnout, characterized by emotional exhaustion, physical fatigue and cognitive weariness. Empirical research suggests that provider burnout negatively impacts quality of care and patient outcomes leading to longer recovery times. [34-37] Additionally as more of the providers' time is spent treating patients, time for learning and growth involving sharing lessons with peers, attending seminars and reflecting on the lessons learned takes a back seat. As a result, providers' knowledge and skill acquisition stagnates. Furthermore, therapeutic alliance, considered to be one of the main factors contributing to positive healthcare outcomes[38, 39], is negatively impacted by provider burnout, characterized by reduction in empathy, which plays a critical role in maintaining strong rapport with patients [40]. As provider burnout and reduction in time for learning and growth contribute to quality of care deterioration, treatment effectiveness decreases leading to longer recovery times and higher rates of relapse, increasing demand as the number of behavioral health encounters per patient grows. Since the leadership does not have visibility into this impact (neither provider satisfaction or quality of care metrics are being reported) and only sees deterioration in access to care metrics, it responds by either keeping patient load requirements at elevated levels or increasing them further leading to a vicious cycle.

R3: Motivation Effect

Another effect of provider burnout on system performance is an increase in turnover rates. As providers get overworked and burned out by the daily stress and long work hours they are more likely to consider switching to less stressful jobs. [41, 42] Additionally, our interviews with

providers indicated that the inability to provide quality care by developing more meaningful relationships with patients and tracking their progress to recovery contributes to their dissatisfaction and leads to stronger considerations to leave their current positions for more fulfilling opportunities. Therefore the changes in quality of care and provider satisfaction reinforce each other forming either a virtuous or vicious cycles.

R5: Enough Is Enough

As turnover increases the system capacity to provide care decreases, exacerbating provider shortage. Resulting deterioration in access to care puts additional pressure on MTF leadership to increase productivity of available providers in order to pick up the slack created by provider attrition. This leads to yet another vicious cycle of high productivity and increasing turnover rates fed by “productivity gain”, “motivation effect” and “enough is enough” feedback loops.

B4: Reputation Effect

Quality of care provided at the behavioral health clinics drive patient satisfaction, which in turn contributes to the number of new patients that decide to seek care at the clinics. We define the quality of care by the strength of therapeutic alliance, compliance to CPGs and treatment effectiveness. Research scholars argue about whether patient satisfaction is an attribute or an indicator of the quality of care. [43] However there is very little doubt about positive relationship between patient satisfaction and word of mouth (WOM). Word of Mouth (WOM) is a term that describes communication about the services from existing customers to potential ones. Therefore patient satisfaction drives WOM, which contributes to the number of new patients that decide to seek care. In fact WOM acts as a balancing factor in demand for care. Improvement in quality of care leads to positive WOM driving more new patients to the clinic. Increased demand strains

access to care, which prompts increases in provider productivity resulting in deterioration in the quality of care. Similarly, deterioration in quality of care results in negative WOM and higher drop out rates, reducing demand for care and deteriorating medical readiness of the military force.

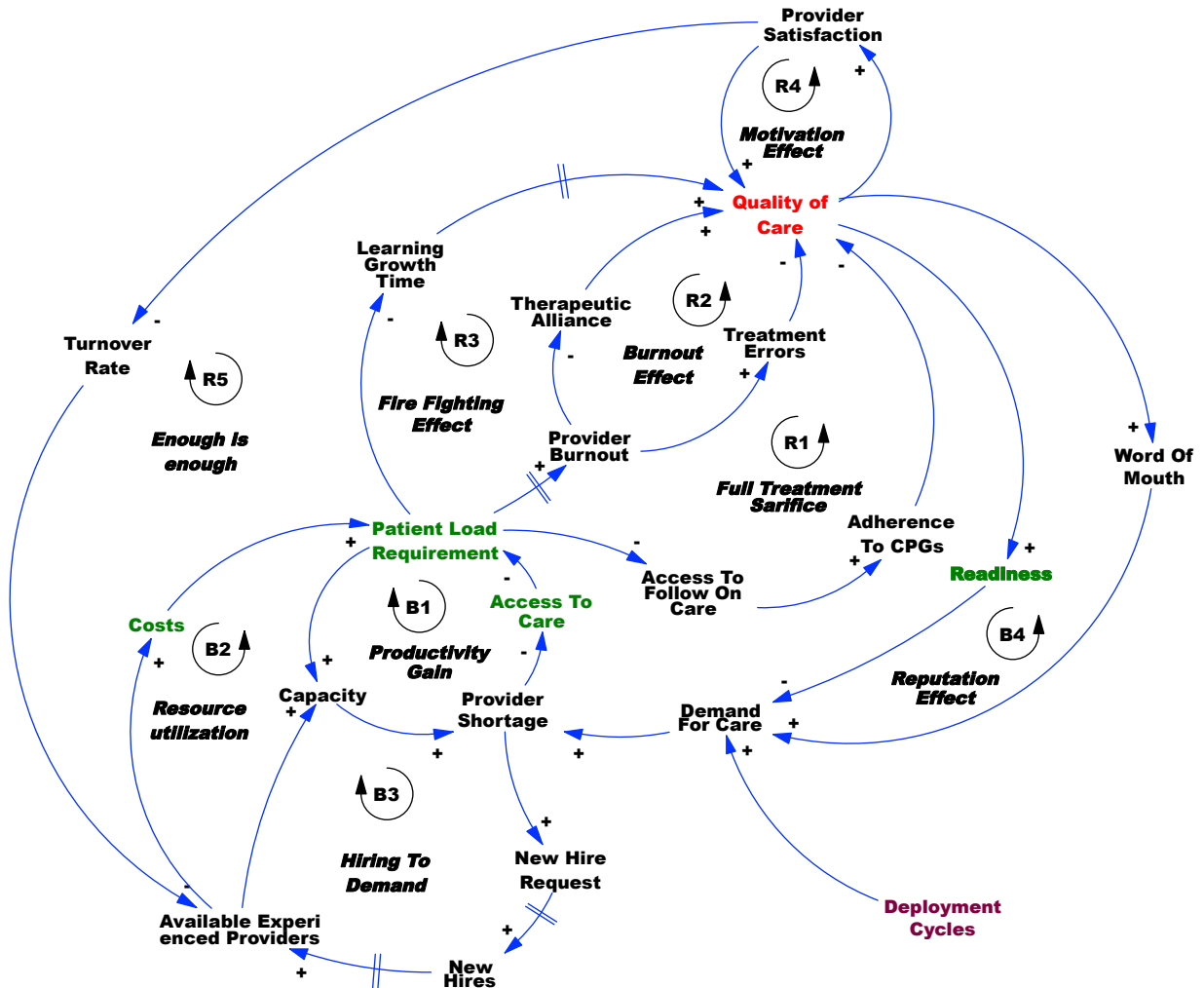


Figure 2 -Full Causal Loop Diagram

4.5 Causal Loop Diagramming Insights

It is apparent from the analysis above that the productivity centric resourcing policy and incentive structures skewed towards increased patient loads and improvement in access to initial care can result in a number of vicious cycles that reinforce provider shortages and result in increased costs and insufficient access to care. Lack of informational feedback about the impact of current policies on the quality of care and recovery times is one of the main reasons they persist. A set of performance measures that includes not only access to initial care and provider productivity indicators but also access to follow on care, provider satisfaction, quality of care and outcome measures could help MTF leadership to better assess the impact of their policies on overall performance of behavioral health clinics.

Although it is clear from this analysis that there are multiple interdependencies among key performance drivers there are several key questions that the causal loop diagram is not able to answer. What is the impact of the delay associated with the hiring process on clinic's ability to meet demand surges in a timely fashion? How long does it take for the high patient load requirement to result in provider burnout and trigger vicious cycles described above? What is the expected medical readiness of our military force given the policies in place? The causal loop diagram does not capture inherent stocks and flows in the system necessary to answer these questions.

Additionally, with multiple delays and feedback loops it is impossible to gauge the combined impact of their interaction on the overall performance of the clinic. Analysis of how patients flow through the system of care is needed to characterize the factors that drive demand for care. Further study of how capacity of the system is being adjusted to meet the demand can reveal leverage points utilization of which may lead to effective policies. System Dynamics modeling method [8] is well

suitable for this task given its applicability for dynamic systems where multiple feedback loops define interrelationships among people, operations and structural elements of organizations.

In the next section we will describe a quantitative model that simulates the flow of patients through the system of military psychological health care and enables longitudinal impact analysis of resourcing policies and incentive structures on the performance of military behavioral health clinics across three dimensions: access, cost and outcomes. The insights from this analysis will lay in the foundation of recommendations that aim to reverse vicious cycles created by current policies.

5 Quantitative Analysis

5.1 Modeling Demand For Care in Behavioral Health Clinics

At the core of our model is the stock and flow structure that captures the movement of service members through the various stages of behavioral health treatment cycle. Accumulation of service members occurs in the following five stocks: (1) healthy population; (2) service members with unidentified behavioral health condition, i.e. condition that has not been identified by the system; (3) service members with identified behavioral health condition, i.e. those that have been referred to mental health professional by his or her commander or primary care provider and those that self-referred themselves to behavioral health clinic and screened positive on one of the standard diagnostic instruments, designed to identify mental health disorders; (4) service members in direct care at military treatment facilities, i.e. those that receive psychotherapy and/or pharmacotherapy at MTFs and (5) service members receiving care at treatment facilities off military bases, usually in one of the Tricare network hospitals. This structure is depicted in Figure 3.

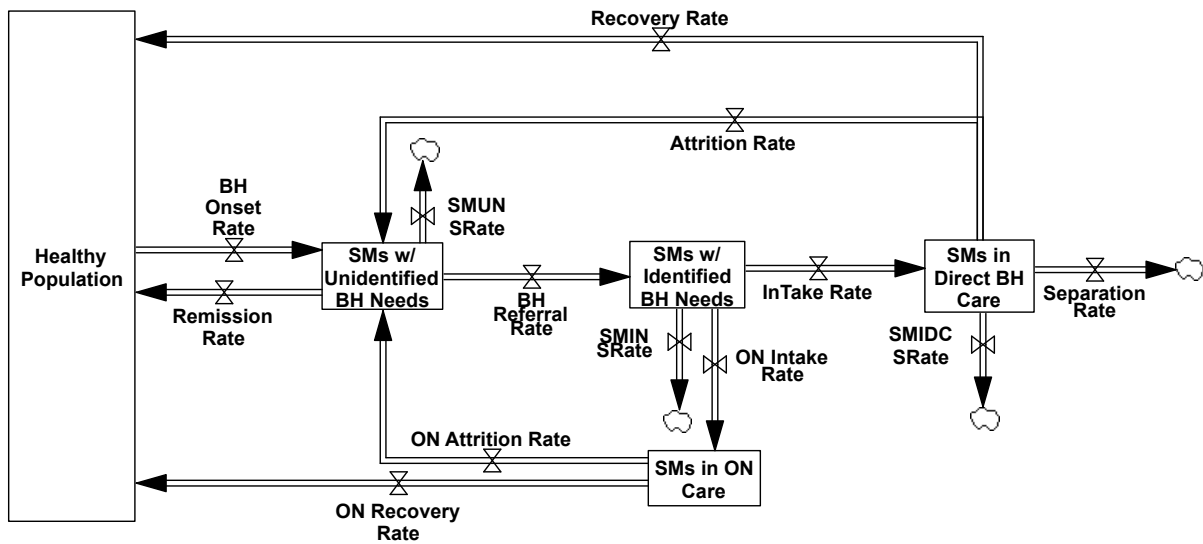


Figure 3 – Population Stock and Flow Structure

The movement of service members across these stocks is governed by inflows and outflows depicted in Figure 3 with valves. For instance BH Onset Rate governs the flow of service members from the stock of healthy population to that of those with unidentified behavioral health condition. Factors like medical histories and resiliency levels of service members, as well as frequency, duration and intensity of the deployment cycles contribute to the onset rates of such combat related conditions as post-traumatic stress disorder (PTSD) and major depressive disorder (MDD). Access to diagnostic instruments and their effectiveness as well as service members’ willingness to give honest feedback about their symptoms in large part determine how many of them get identified and referred to mental health services. Once a service member screens positive on one of the standard diagnostic tools, he or she is required to schedule at least one appointment with the behavioral health provider. During this initial appointment the behavioral health provider assesses the service member’s mental state and makes a recommendation for further treatment if needed. If the service

member decides to follow provider's recommendation an intake appointment is scheduled. During the intake appointment a thorough assessment of service member's condition is conducted and jointly with the patient provider decides on a course of treatment. At this point the service members starts his or her treatment and joins the population of patients in direct care. Severity of the patient's condition, willingness to receive and adhere to treatment as well as its duration and effectiveness determine how long the patient will stay in treatment. After receiving a full course of treatment (on average seven psychotherapy sessions) behavioral health provider reassesses his or her progress and makes a decision as to whether the service member is in full remission, in partial remission and therefore requires additional treatment, or has a condition severe enough to be grounds for separation from the military service.

In order to take into account increasing suicide rates [44] in the model we included suicide rates from every stock accumulating service members as they move through the system of care. The assumption is that the fraction of suicides is highest in the stocks of service members with BH conditions, not in direct treatment and lowest in the healthy population stock.

5.2 Modeling Resource Management in Behavioral Health Clinics

From the resource management perspective a major decision point for BH clinic chiefs is how to allocate providers time between offering initial care to new patients and providing follow up care to existing patients. This decision is largely based on the size of provider patient panels, the number of patients they see in a given week and the time between each follow up appointment. Typically once the service member goes through a formal intake appointment, he or she is recommended to undergo treatment consisting of psychotherapeutic and or pharmacological appointments.

Although behavioral health status of a service member is typically re-assessed at each appointment, the formal determination of whether the service member can be considered to be in remission or has to continue treatment is done by his or her provider after completion of a full treatment cycle consisting of 7-10 psychotherapy sessions.

Behavioral health providers' capacity to treat patients and take in new ones is determined by the number appointments they can offer in a given week and the average time between each follow up appointments. So for instance, a provider who can offer 35 appointments in a given week can provide care to either 35 patients, seen on a weekly basis or 70 patients seen bi-weekly. If the gap between follow up appointments is allowed to go up to three weeks, a providers' patient panel can grow to over a 100 patients.

5.2.1 Utilization of Existing Capacity

The capacity of BH clinic is largely based on the number of providers and their productivity levels. In our model we will calculate capacity of the system as the total number of providers, adjusted by relatively lower productivity levels of new providers. Overall fatigue/burnout levels are also accounted for in calculation of total service capacity.

Service Capacity

*= (Credentialed Providers + Rookie Providers * Rookie Productivity Fraction)*

** Effect of Fatigue on Productivity*

Where *Effect of Fatigue on Productivity* is modeled as a nonlinear decreasing fraction with longer workweek resulting in lower productivity.

Base Case

Table of Effect of Fatigue on Productivity

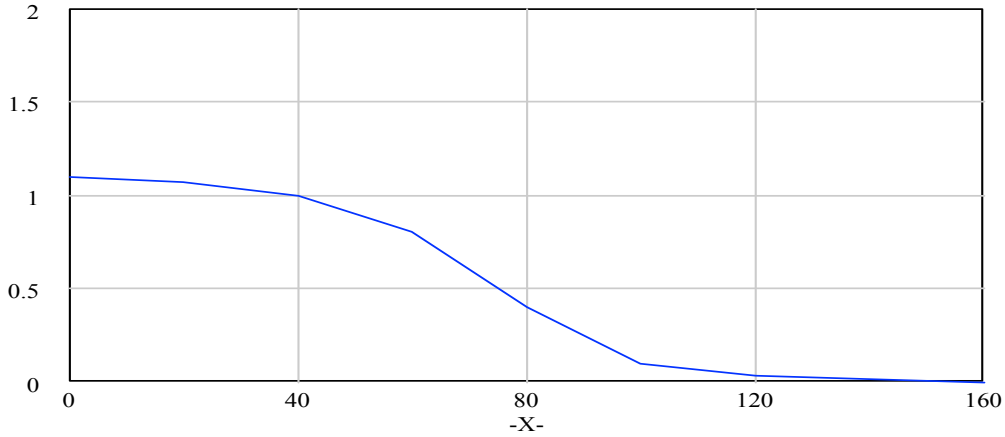


Figure 4 – Effect of Fatigue on Productivity as a Function of Recent Workweek

The pace at which patients are able to flow through the system of care is determined by system capacity. The three flows that capacity impacts directly are:

- In-take rate, which describes the number of patients able to get their first appointments in a given week.

$$Intake\ Rate = \text{Max}\left(\frac{SMs\ w\ Identified\ BH\ Needs}{Min\ Waiting\ Time}, \frac{Service\ Capacity * InTake\ Workweek}{InTake\ Appointment\ Time}\right)$$

Where

$$Intake\ Workweek = Total\ Workweek * Intake\ Workweek\ Fraction$$

- Out of Network Referral rate, which describes the pace at which SMs are being referred to receive care in the Tricare network hospitals. It is a function of Intake Rate and the maximum appointment wait time tolerated by the system before service members are referred out of the clinic.

$$Out\ of\ Network\ Referral\ Rate = \text{Max}\left(0, \frac{SMs\ w\ Identified\ BH\ Need}{Wait\ Time\ Limit} - Intake\ Rate\right)$$

- Recovery rate, which describes the pace at which SMs recover from their condition after going through the full course of treatment.

$$\text{Recovery Rate} = \frac{1}{\text{Treatment Time}} * \text{Recovery Fraction}$$

Where

$$\text{Treatment Time} = \text{Number of Encounters} * \text{Time Between Appointments}$$

And

$$\text{Time Between Appointments} = \text{Max}(7, 7 * \frac{\# \text{ of SMs in Direct Care} * \text{Encounter Duration}}{\text{Service Capacity} * \text{Care Workweek}})$$

Note that Recovery Fraction varies between 0.2 and 0.8. The fraction of service members that receive full treatment but do not reach full remission stay in the stock of those in direct care to receive further treatment. This formulation is based on clinical practice guidelines of all major behavioral health conditions, which recommend that unless the service member fully recovers and does not present residual symptoms he or she should continue treatment and be re-assessed at a later stage. Our model does not differentiate between patients that are in treatment for the first time and those that are in continued treatment after reassessment. In reality the types and the frequency of follow up appointments change based on service members' response to initial treatment.

The pace at which patients recover is also determined by their ability to receive timely evidence-based treatment. Our interviews have shown that at BH clinics with constrained capacities, demand surges force clinics' management to make tough decisions about how to distribute limited resources among provision of care to new patients and compliance to the clinical practice

guidelines while providing care to those that are already in treatment. As one behavioral health providers noted: “The cost of providing ‘golden standard of care’ to forty patients is inability to schedule first appointments for hundreds of new patients”.

BH clinic management has two levers that control the inflow of new patients into the system: the number of credentialed providers and their capacity to take on new patients. Desired intake capacity ensures that all new patients obtain their first appointments within access to care standards. Intake rates lower than the desired level result in deterioration of access to care performance metrics and pressure to increase intake capacity by increasing intake workweek, i.e. the number of provider hours dedicated to new patients. We model intake workweek pressure in the following way:

$$\text{InTake Work Pressure} = \frac{\text{Desired Intake Capacity}}{\text{Service Capacity}},$$

Where

$$\text{Desired Intake Capacity} = \text{MAX}\left(0, \frac{\text{Desired Intake Rate} * \text{Intake Apointment Time}}{\text{Total Std Workweek} * \text{Std Intake Workweek Fraction}}\right)$$

And,

$$\text{Desired Intake Rate} = \text{SMs with Identified BH Condition} * \left(\frac{(1 - \text{Urgent Cases Fraction})}{\text{Routine Target Wait Time}} + \frac{\text{Urgent Cases Fraction}}{\text{Urgent Target Wait Time}} \right)$$

The effect of Intake Work Pressure on Intake Workweek Fraction is described by the graph below, where it varies from 0.75 to 1.25 as a function of the ratio between desired intake capacity and actual intake capacity.

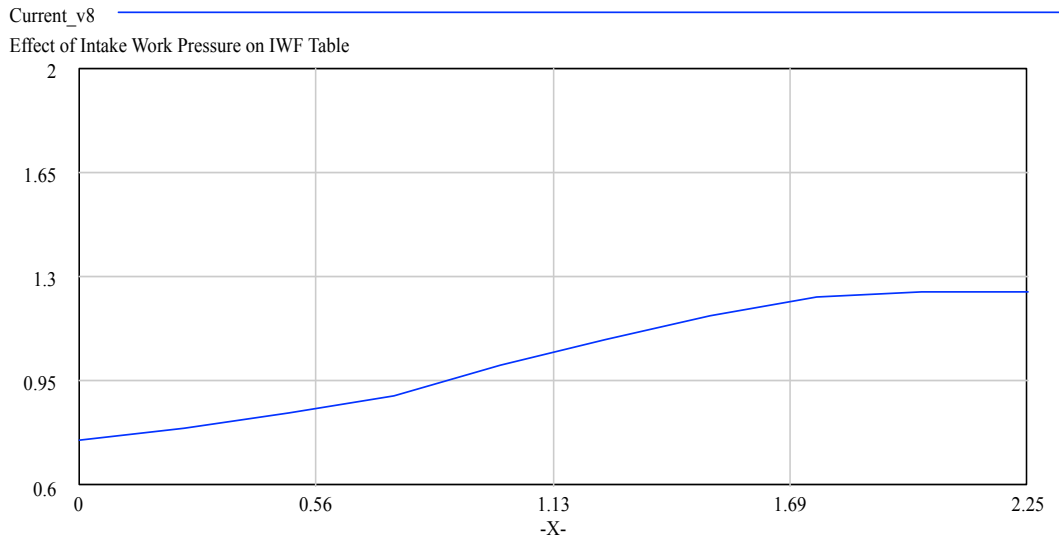


Figure 5 - Effect of Intake Work Pressure on Intake Workweek Fraction as a Function of Intake Work Pressure

Intake work pressure contributes to increases in intake workweek fraction which determines the number of hours each provider spends on doing intake appointments and adding new patients to their panels.

However increases in the number of hours spent on intakes necessarily decreases the time remaining on treating existing patients all else being equal. Therefore as intake workweek increases, care workweek decreases. As a result gaps between follow up appointments grows and treatment rates decrease, creating work pressure to increase treatment capacity.

$$\text{Care Workweek Pressure} = \frac{\text{Desired Care Capacity}}{\text{Service Capacity}}$$

Where

$$\text{Desired Care Capacity} = \text{MAX}\left(0, \frac{\text{Desired Treatment Rate} * \text{Number of Encounters} * \text{Encounter Duration}}{\text{Total Std Workweek} * (1 - \text{Std Intake Workweek Fraction})}\right)$$

And

$$\text{Desired Treatment Rate} = \frac{\text{SMs in Direct Care}}{\text{Target Treatment Time}}$$

The effect of Care Workweek Pressure on Intake Workweek fraction is modeled to be relatively minor until Care Workweek Pressure reaches a certain threshold. In the graph below it is set to 2.5, which corresponds to the number of weeks between follow up treatment appointments.

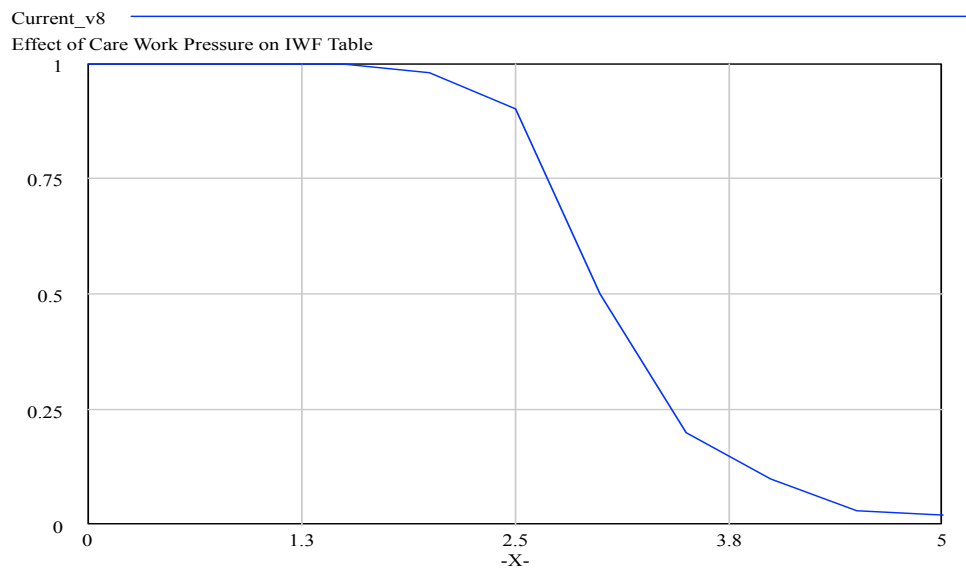


Figure 6 - Effect of Care Work Pressure on Intake Workweek Fraction as a Function of Care Work Pressure

Evidence based treatment requires this gap to be no more than one week. However our interviews showed that during demand surges time between appointments is allowed to go up to 3 weeks in order to accommodate more new patients. However when all of the providers reach their maximum allowed patient loads new patients are referred to the Tricare network clinics until capacity is freed up by recovering patients or additional providers are brought on board.

In order to better test the impact of care workweek pressure on intake workweek fraction we modeled *Effect of Care Work Pressure on Intake Workweek Fraction* using a Logit function:

Effect of Care Work Pressure

$$= \frac{1}{(1 + \exp(-\text{Gap Threshold}) * \exp(\text{Care Work Pressure}))^{\text{Sensitivity To Care Pressure}}}$$

Gap Threshold is a variable that controls at what point of the *Care Work Pressure* will the *Effect of Care Work Pressure* be 0.5, while *Sensitivity To Care Pressure* controls the steepness of the curve.

Equation below depicts combined impact of the intake and care work pressures on intake workweek fraction.

Intake Workweek Fraction

$$= \text{Std Intake Workweek Fraction} * \text{Effect Of Intake Work Pressure} * \text{Effect Of Care Work Pressure}$$

Therefore combined effect of intake and care capacity constraints on intake workweek fraction is driven largely by intake work pressure until the time between follow up appointments and the patient load increases to a threshold, after which care work pressure effect starts to take priority. This threshold, which is also reflected in maximum allowed patient loads, is one of the key policy levers at the disposal of BH clinic management.

5.2.2 Capacity Acquisition Processes

Another way to relieve intake and follow up care pressures is to hire new providers and increase capacity of the overall system. However as mentioned in section 3.1 hiring processes involve multiple delays, which contribute to a build up of the work pressure and associated negative consequences.

To model workforce authorized to be hired we first calculate available budget, which is based on revenue generated from every appointment provided. We then find the number of providers that can be afforded, by subtracting the cost of each provider and fraction of revenues needed for operations of the clinic from available budget. Authorized workforce then is a minimum of the number of providers afforded by the budget and the number of providers needed to maintain desired intake and treatment rate levels.

To find the number of providers that can be hired we take the difference between authorized workforce and total number of providers operating in the clinic. To account for the delays associated with hiring, training and credentialing providers we created a stock in flow structure where first Vacancies are accumulated by the inflow of new hire requests and the outflow of positions filled in the job market. Once the new hire is added to the workforce there is a non-negligible period associated with training and credentialing. This is captured in accumulation of new providers in the Rookie Providers stock. Once new hires get credentialed and trained they accumulate in the stock of Credentialed Providers. This structure is depicted in Figure 7 below. Note that this structure is identical to the one developed by [7]

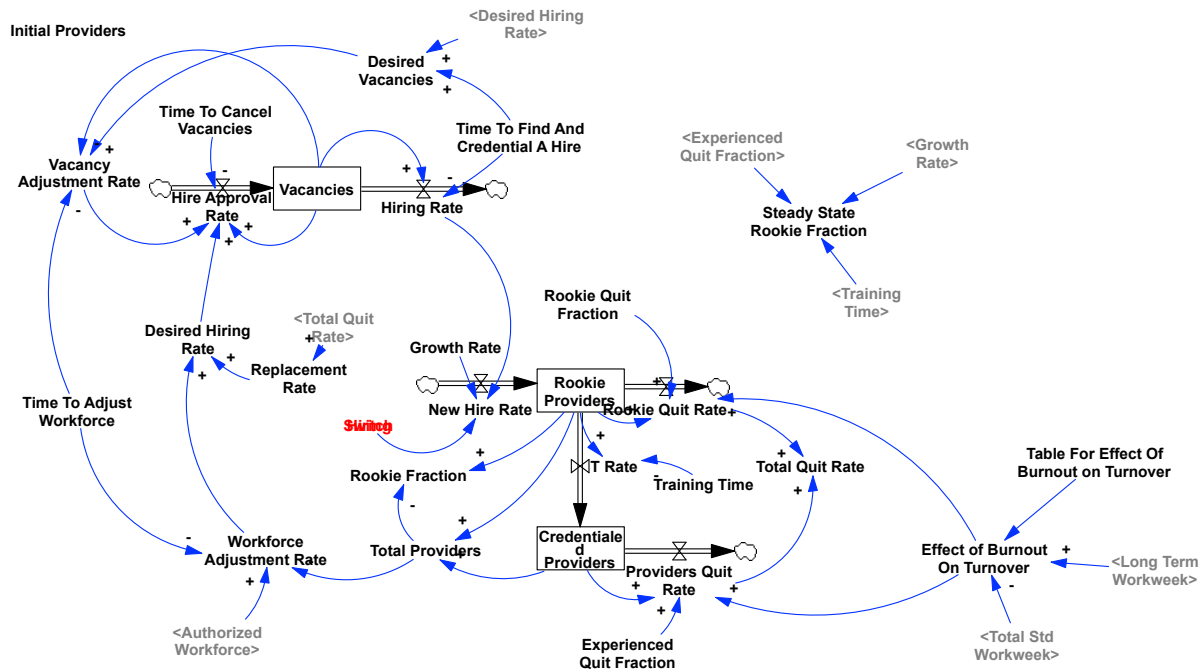


Figure 7 - Hiring Stock and Flow Structure

5.3 Modeling The Impact of Resourcing policies on Recovery Rates

We modeled the impact of resourcing policies on the quality of care, attrition and recovery rates by considering a set of factors that impact attractiveness of care and recovery fraction of patients in treatment.

Based on empirical research and anecdotal evidence from our interviews, recovery fraction of service members in treatment is around 70% [31]. However this fraction assumes that the service members receive evidence based treatment by experienced healthcare providers. The model

assumes evidence based treatment includes seven weekly therapy sessions. Furthermore we model actual recovery fraction impacted by the following factors:

- Average experience of healthcare providers based on the rookie fraction
- Fatigue levels of providers based on recent workweek relative to the standard workweek
- Time between each therapy appointment, based on available care service capacity.

The impact of each of these factors on recovery fraction is modeled separately; please refer to the Appendix for a detailed formulation.

Average experience of healthcare providers factors in the fraction of providers that are still rookies and need to be credentialed before they can start treating patients. The impact of inexperience on recovery fraction is modeled as a non-linear increasing function of a relative effectiveness of the workforce, such that the smaller the rookie fraction and the higher the rookie production, the lower the negative impact on the recovery fraction.

The impact of provider fatigue on recovery fraction is modeled as a non-linear function of relative workweek. As providers work longer hours for extended periods of time, fatigue levels start to impact providers' ability to provide effective treatment first only slightly and then substantially.

The impact of the time between each therapy appointment on recovery fraction is modeled as a decreasing non-linear function varying between 1 and 0.2. Evidence based treatment on which base recovery fraction is based on assumes weekly therapy sessions. Therefore it is reasonable to assume that the longer the time between each therapy session, the lower the treatment effectiveness, partially due to lower probably of adherence to treatment as well as strain on provider-patient alliance.

With these three factors in mind, we find recovery fraction using the following expression:

Recovery Fraction

= Base Recovery Fraction

** (Effect of Fatigue of Providers * Effect of Inexperience of Provider*

** Effect of Time Between Appointments)^{Sensitivity Of Recovery Fraction To Effects}*

We also modeled attractiveness of care based on the following factors:

- Apathy of providers driven by their fatigue levels
- Actual treatment effectiveness relative to expectations
- Waiting times to access initial care relative to expectations
- Treatment time relative to expectations.

Attractiveness of Care

*= SMOOTH((Effect of Apathy * Effect of Treatment Effectiveness*

** Effect of Treatment Waiting Time*

** Effect of Access to Care, Time to React to Quality of Care)^{Sensitivity Of Aoc To Effects, Time To React To Care)}*

5.4 Model Assumptions And Limitations

We've developed the model based on numerous interviews, site visits, review of relevant empirical research as well as official policy documents describing clinical practice guidelines followed by the clinics. However we were unable to gain access to quantitative data of patient encounters and clinic specific capacity information. In that light we've developed a stylized simulation model that can be calibrated to the operations of specific clinics once data becomes available. The list of assumptions we've used while developing the model are listed below.

- 1) Deployment and redeployment of service members is modeled through changes in referral rates only. However the model is capable of modeling more detailed and realistic scenarios that reflect the timing and sizes of deployment cycles using the mirrored structure of service members flow through the system of care in theatre and on military bases. Please refer to Appendix for a graphical representation of patient flow that includes deployment cycles.
- 2) No differentiation is made among different types of behavioral health conditions common in service members. The model is based on PTSD and MDD conditions requiring 7-10 psychotherapy appointments before reassessment of service member can be made.
- 3) The model assumes that every service member, referred to the behavioral health clinic is required to schedule and keep at least one appointment with mental health provider. Therefore every service member in the *SMS w/ Identified BH Condition* stock either receives an intake at BH clinic or in the Network Tricare hospital. Attrition fraction includes the fact that a large proportion of service members drop out after the first appointment.
- 4) The model assumes that the clinic has capability to offload proportion of care demand to network Tricare hospitals. This is not possible in all military bases. The model also assumes

that the service members are diverted to network Tricare hospitals when the waiting time for a routine appointment exceeds four weeks.

- 5) The model does not differentiate between different types of behavioral health providers (i.e. social workers, psychologists, nurse practitioners and psychiatrists). The simplifying assumption is made to treat all behavioral health assets uniform.
- 6) Service capacity is used only to provide intake appointments to new patients and ongoing follow up therapy appointments to existing patients.
- 7) Once in direct treatment the model assumes that each service member that does not drop out of care receives at least 7 follow up appointments after which he or she either recovers and rejoins healthy population or stays in treatment for further treatment. Therefore the model does not distinguish between service members that are receiving treatment for the first time and those that have been through multiple treatment cycles.
- 8) The model assumes that service members that drop out of care join the stock of those with unidentified BH condition. We use remission fraction from SMs w/ Unidentified BH Condition to account for service members that drop out of care because they no longer have symptoms of BH condition and therefore will rejoin the health population.
- 9) The model does not account for the fact that separation rate dictating the flow of service members out of the military system based on severity of behavioral health condition is driven partially by the availability of behavioral health assets to perform the work necessary to process separation paperwork. The model assumes that separation rate does not consume any capacity of the system.
- 10) Suicide fraction of service members with behavioral health condition, unidentified by the system is substantially higher than of those that are healthy or in treatment, driven by

research showing higher suicide rates for people that do not receive evidence based treatment.

- 11) Due to insufficient data, non-linear table functions used to model the impact of provider inexperience and fatigue on the recovery fraction of service members in treatment were not validated and were based on anecdotal data from interviews. To address this issue we performed sensitivity analysis that tested our findings with a range of potential impacts of these factors on the recovery fraction.
- 12) Due to insufficient data, impact of fatigue driven apathy of providers, prolonged access and treatment waiting times and treatment effectiveness on attractiveness of care were modeled without validation. To address this modeling weakness we conducted sensitivity analysis to test robustness of our findings and recommendations with a range of potential impacts of these factors.
- 13) Fractional hazard rates that govern the flow of patients through the system of care were derived from population level empirical studies and were not calibrated to specific clinics.

5.5 Simulation – Focus On Demand Surges

Interviews and empirical research [45] showed that demand surges are common in military behavioral health clinics that serve active duty population stationed on power projecting platforms (i.e. Army Installation from which high priority active component brigades deploy and come back from deployment). These demand surges are largely correlated with deployment cycles and result from large number of service members coming back from deployment. However because military

budget and resulting staffing decisions are made based on utilization of mental health services not actual need, behavioral health clinics respond to demand surges as they come.

In order to test the impact of resourcing policies on access to care and overall clinics effectiveness of managing demand for care we ran multiple simulation scenarios keeping the initial conditions, the size and timing of demand surge the same, while varying three key policy levers: maximum provider Patient Loads, Time To Adjust Affordable Workforce, Credentialing Time.

5.5.1 Initial Conditions

We start every simulation with a system in a dynamic equilibrium where the capacity is perfectly matched to internal and external demand for care. Initial capacity of the simulated clinic consists of 20 behavioral health providers, working standard 40 hour workweek with a patient load of 33 patients, and intake workweek fraction of 16%, corresponding to about 6 hours of week dedicated to providing appointments to new patients. Initial demand for the clinic is characterized by the number of service members in each of the accumulation stocks in the system and fractional rates governing the inflows and the outflows.

5.5.2 Modeling Demand Surge

To simulate a demand surge we introduce a spike in BH Referral Rate, which governs the flow of patients from the stock of *SMs with Unidentified BH Condition* and *SMs w/ Identified BH Condition*. *BH Referral Rate* stays elevated for three months after which it drops back below the initial equilibrium level before slowly rising back to the equilibrium.

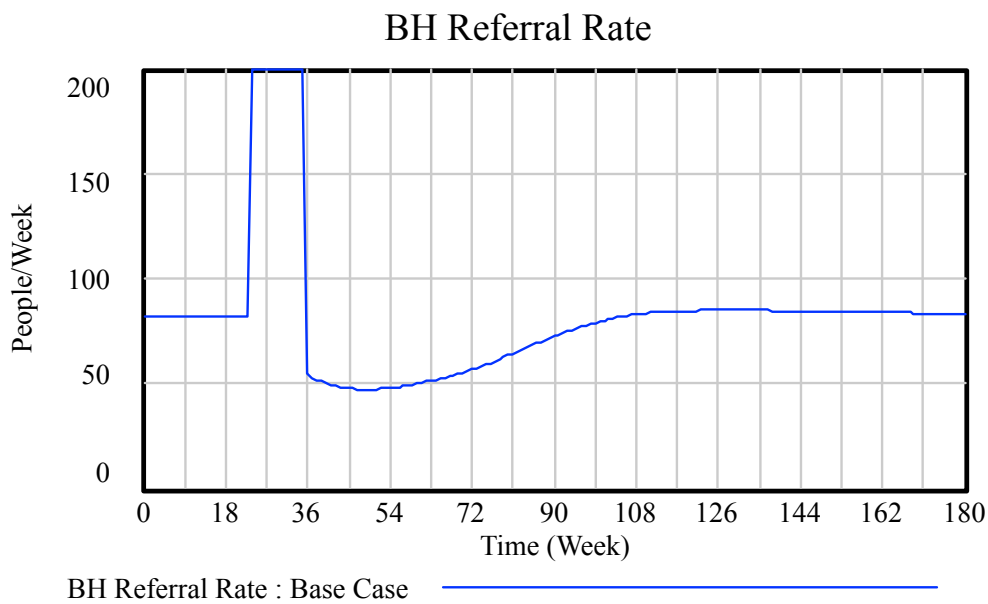


Figure 8 – BH Referral Rate Spike simulating a demand surge

Figure 8 depicts referral rates that start at the equilibrium value (i.e. the value that conforms to the initial conditions of initialization of the system in dynamic equilibrium) and then spikes up to 200 service members/week for four weeks after which point drops off again and slowly approaches initial value. The reason the referral rate drops below the initial equilibrium level after the surge and takes a sometime to reach equilibrium again is because there is a considerable delay between the time service members get referred to mental health services and either drop out of care and rejoin the population of service members with unidentified BH condition or recover and re-join healthy population.

5.5.3 Response of an uncapacitated system

To draw contrast with the “ideal” system response to the demand surge we took away the impact of capacity restriction on intake and treatment rates. Compared to capacity constrained system

accumulation of service members in the stock of those awaiting their first appointment is substantially smaller, as they are quickly processed and admitted to direct treatment.

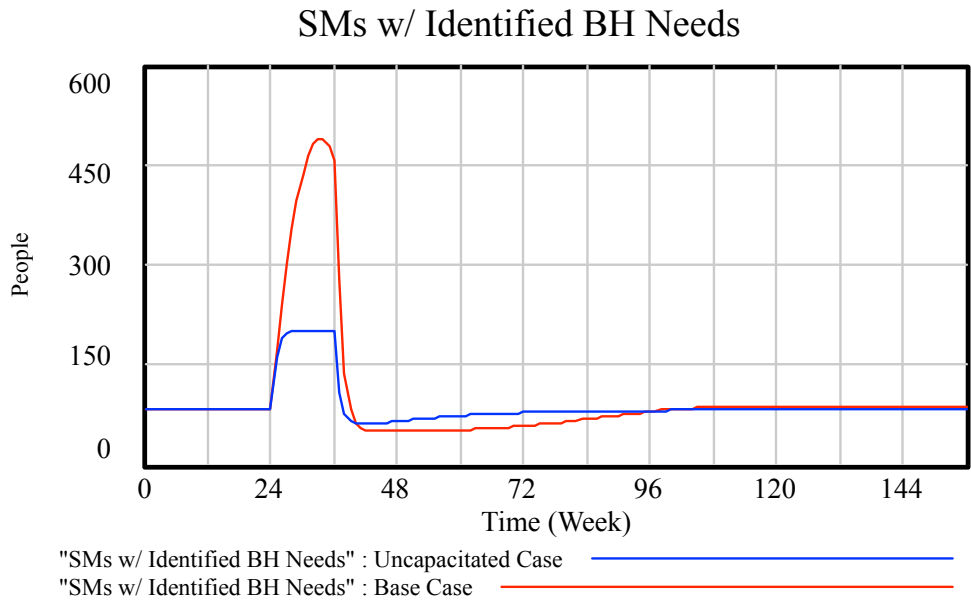


Figure 9 - System Response To The Demand Surge – Accumulation of SMs waiting to access care

Consequently uncapacitated system admits patients in direct treatment stock faster and processes them out of it sooner as evident in the graph below.

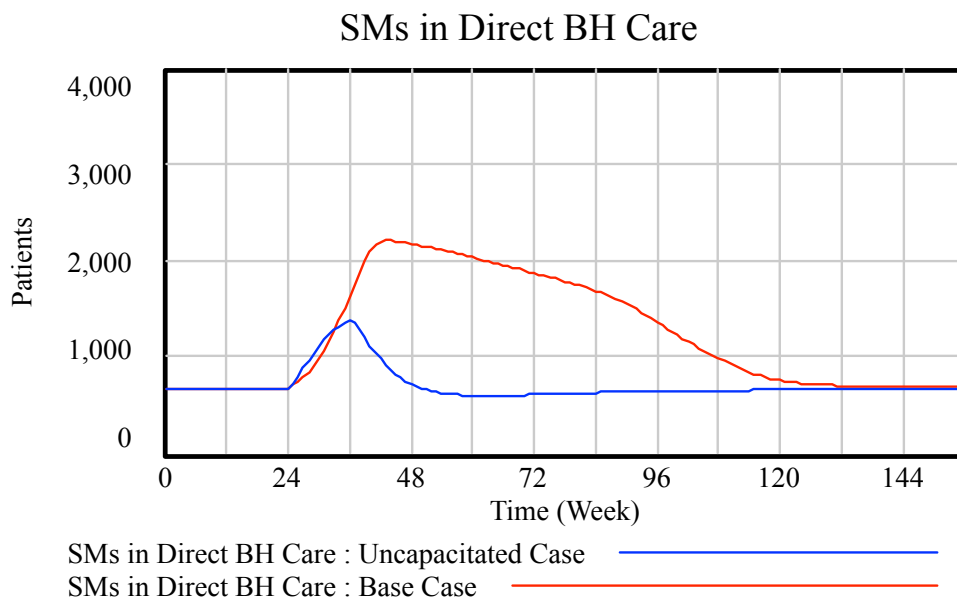


Figure 10 - System Response To The Demand Surge – Accumulation in Direct Care

5.5.4 Response of a capacity constrained system

As discussed in section 4.2, BH clinic management has two main capacity levers that influence the flow of patients through the system. The first one is allocation of providers' time among new patients looking for their intake appointments and existing follow up patients. In the state of equilibrium, providers break up their workweek in a way that enables all new patients looking to get their intake appointments obtain them according to access to care standards (i.e. 1 week for routine appointment and within 24 hours for urgent appointment), An increase of service members looking to get their intake appointment creates pressure to allocate more of providers workweek hours on processing new patients. As intake workweek increases and more new patients enter direct treatment, treatment rate drops below desired treatment rate, increasing the pressure to reduce intake workweek fraction. Intake workweek fraction increases until patient load maximum

threshold is reached, at which point the fraction starts to decrease and alleviate some of the care work pressure. Graph below depicts how the hours providers spend on intakes changes based on intake and care work pressures.

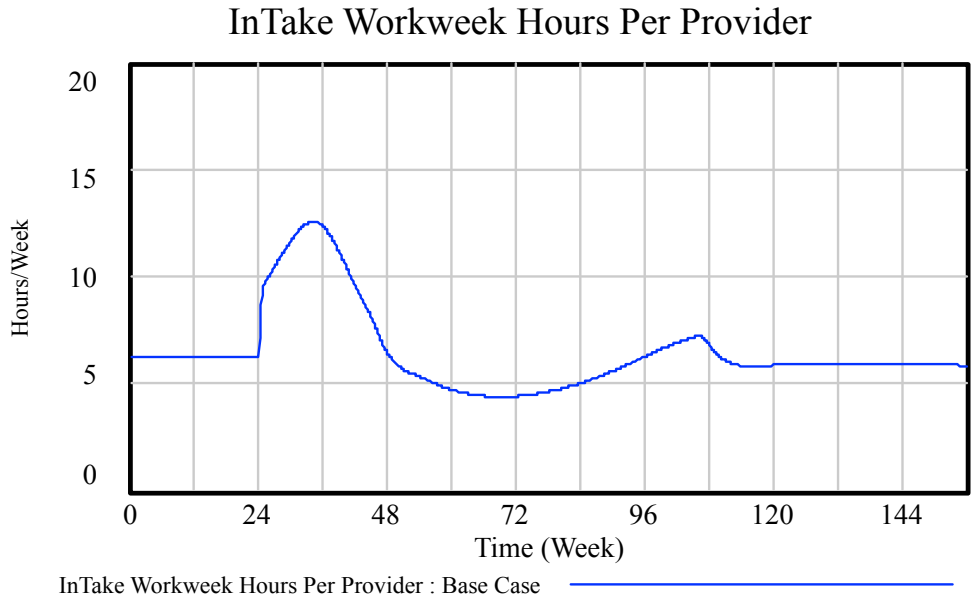


Figure 11 - System Response To The Demand Surge - Number Of Hours Each Provider Spends on Intakes

The second capacity lever available to BH clinic management is that of hiring new providers to increase overall system capacity. This process involves budget approvals and credentialing hurdles, which combined with additional difficulties of filling open positions once approved result in long delays and inability to match actual service capacity to the desired service capacity in a timely fashion.

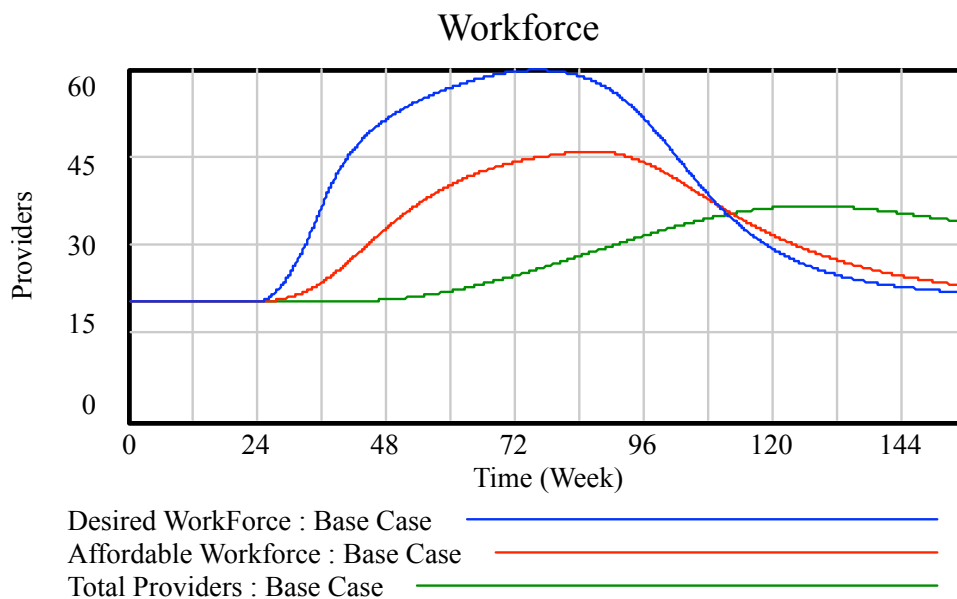


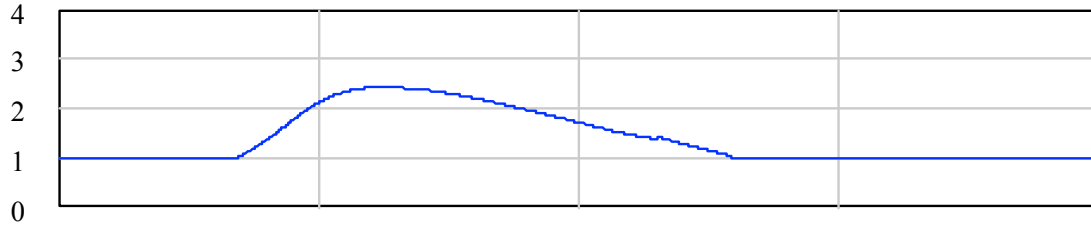
Figure 12 - System Response To The Demand Surge – Acquisition of Additional Capacity

The pace at which service members recover from behavioral health condition once admitted to the clinic as direct care patients is dependent partly on the rates of treatment and partly on the recovery fraction of those that receive it.

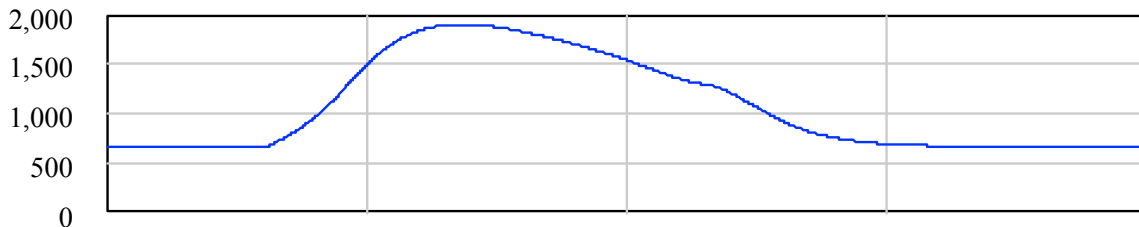
The treatment rate is driven by the capacity of the system to provide a set of therapy appointments. This capacity is determined by the number of providers and the number of weekly hours they dedicate to follow up appointments. Given that acquisition of new providers involves delays and the Care workweek decreases initially under the pressure to increase the intake rate of new patients, provider patient loads increase and their limited time is split among larger number of patients, resulting in longer gaps between follow up appointments for the patients.

Base Case

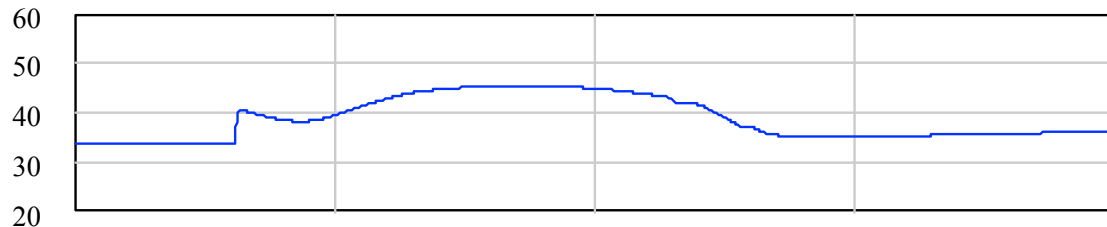
Time Between Appointments



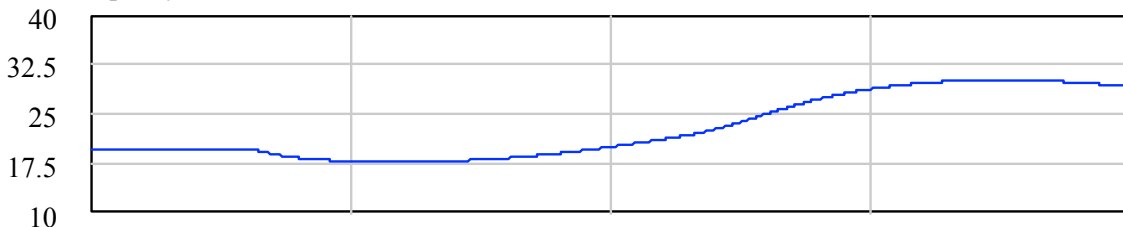
SMs in Direct BH Care



Care Workweek Hours Per Provider



Service Capacity



0 39 78 117 156
Time (Week)

Encounter Duration

Base Case: 1

Figure 13 - Service Response To The Demand Surge - Impact On Time Between Follow Up Appointments

Recovery fraction of those that receive treatment starts off at a pre-determined base level and can be negatively impacted by three factors: the time between appointments, inexperience of providers and provider fatigue. The impact of these factors increase as capacity becomes more constrained.

Time between appointments grows as providers' limited time is spread over increasing number of patients. Provider fatigue levels increases as total workweek increases to 50 hours under the pressure to improve access to care. Inexperience of providers increases as new hires are added to the staff rapidly and turnover of existing providers grows.

Recovery fraction determines the proportion of service members that recover from BH condition after completing a full course of treatment. The graph below depicts how decrease in recovery fraction impacts the number of service members able to recover in a given week. The decrease in recovery fraction and a resulting drop in recovery rate necessarily mean that people stay in treatment longer, using up more of clinic's capacity as the number of encounters per patients increases.

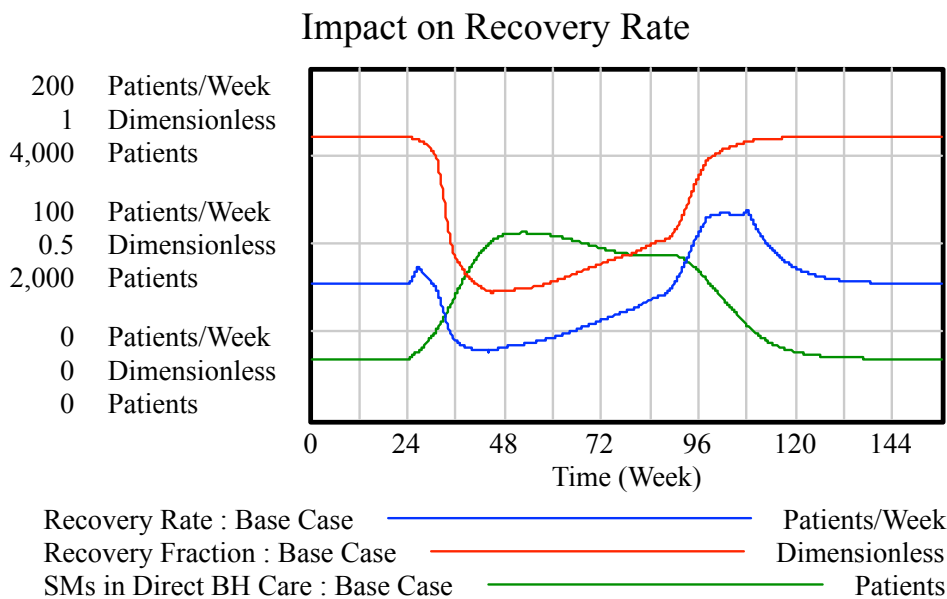


Figure 14 –System Response To The Demand Surge: Impact of Resourcing Policies on Recovery Rate

A starker picture of how throughput and access to initial care focused policies impact clinic’s ability to contribute to medical readiness of service members can be seen in the graph below. It depicts three scenarios of service members accumulating in direct care: uncapacitated system, a capacity constrained system with no impact of resourcing policies on treatment effectiveness and the same system with the impact of resourcing policies on treatment effectiveness shown.

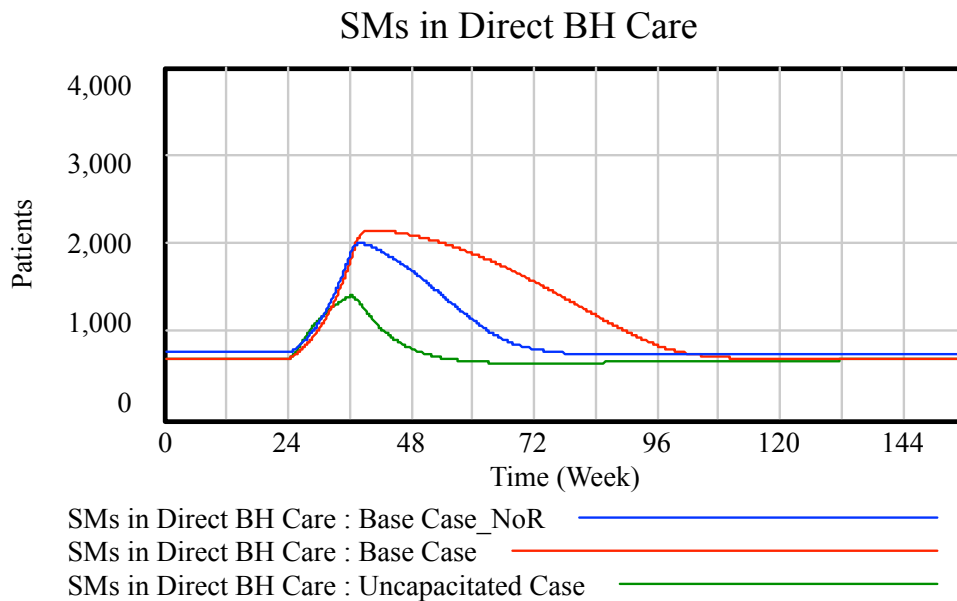


Figure 15 - System Response To The Demand Surge: Impact Of Treatment Effectiveness On Internal Demand

5.6 Modeling Insights

The goal of this analysis was to capture potential impact of resourcing policies and incentive structures on the performance of military behavioral health clinics and help answer the question of why current policies have been unsuccessful in improving effectiveness of behavioral health care provision. Our analysis shows that resourcing policies have significant impact on clinic’s ability to meet the demand for care from new and existing patients. While improving access to initial care the policies that emphasize provider productivity and improvement of access to initial care has the

potential of triggering a set of vicious cycles that result in provider burnout, deterioration of treatment effectiveness and worsening of access to care.

A policy of increasing patient load requirements to improve access to initial care during demand surges leads to a set of unintended consequences:

- As providers dedicate more of their time to taking in new patients their ability to see existing patients on a weekly basis decreases. This results in longer treatment times due to the increase in the times between follow up appointments.
- As the average time between each therapy appointment increases, provider-patients alliance suffers and the effectiveness of treatment decreases.
- As providers' workweek increases, fatigue levels set in, which underscores their ability to provide quality care lowering their productivity, ability to empathize with the patient as well as increasing the likelihood of medical errors.
- As treatment effectiveness decreases and treatment times increase, service members stay in treatment longer, increasing internal demand for care and reinforcing capacity shortage in clinics.
- Decreased treatment effectiveness and deteriorating access to initial and follow up care, result in higher attrition rates and lower proportion of service members seeking care.
- The policy of determining additional capacity needs based on yearly budgets calculated using historical utilization pattern results in a mismatch between service capacity and demand. Delays in hiring, credentialing and training of new providers contributes to the build up of work pressure, prolonged treatment times and deterioration of treatment effectiveness.

Overall our analysis showed that current resourcing policies and incentive structures hinder clinics' ability to effectively manage the demand surges.

5.7 Policy Recommendations

Simulation results show that military behavioral health clinics are vulnerable to a number of self-reinforcing processes, which can be triggered by demand surges and reinforced by current resourcing policies and incentive structures. Emphasis on meeting access to initial care standards incentivizes providers to dedicate more of their time to new patients at the cost of providing lower quality care to existing patients. Given that performance reviews do not include outcome measures that track treatment effectiveness or patient satisfaction surveys and instead emphasize provider productivity based on RVU production and patient loads, providers are incentivized to focus all their effort on seeing as many patients as possible without very much insight on how increased productivity could impact healthcare outcomes.

Limiting patient load requirements

The size of patient panels that each provider carries determines their capacity to take on new patients. Limiting the maximum number of patients they can carry will make sure that the time between each follow up appointment for their patients does not grow beyond the point at which provider patient alliance and treatment effectiveness start to suffer.

Including quality/treatment effectiveness metrics in provider performance reviews

Balancing provider performance across productivity and treatment effectiveness based measures will send a clear signal to providers that along with their productivity and the number of patients they see, they have to make sure that the effectiveness of treatment provided does not suffer.

Tracking the number of encounters per patient, along with patient satisfaction scores, in addition to RVU production will help encourage providers to optimize their performance across productivity and quality. Reporting a balanced set of metrics across access, utilization, cost and quality up the chain of command will give MHS leadership sufficient informational feedback to better interpret the impact of key policies on clinics performance.

Improving Capacity Acquisition Processes

BH clinics' budgets are calculated based on the past RVU production and adjusted up or down using projected future demand a year in advance. However our interviews showed that these projections are almost never accurate in part due to the fact that deployment related factors contributing to the onset of BH conditions change dynamically throughout the year. As BH clinic management struggles to match its constrained capacity to demand surges, approvals to hire needed providers are done on ad hoc basis. Moreover, the hiring budgets do not account for unmet demand from new and existing patients. Developing a more rigorous methodology of calculating unmet internal demand that goes beyond historical RVU production can reduce intake and care work pressure buildup and prevent vicious cycles that lead to deterioration of treatment effectiveness and additional demand generated from patients needing extended care.

Reducing delays associated with hiring, credentialing and training new hires.

Our interviews indicated that delays associated with hiring and credentialing new providers are unnecessarily long due to multiple layers of approval that need to be passed before a new provider can start treating patients. Reducing these delays can contribute to faster response to capacity acquisition needs and a faster reduction work pressure buildup.

Maintaining Reserve Capacity

Even if policies presented are implemented, their impact will be minimal in an environment of tightening budgets. Cost containment and resource utilization has been the focus of existing policies, largely driven by exponentially increasing costs in the past several years. As a result management tightened its budgeting processes to make sure that resources are fully utilized before acquisition of new ones is warranted. In an environment where managers are incentivized to demonstrate waste reduction and cost savings, reserving capacity for unexpected variation of demand are highly contentious. Moreover, tight budget environment prevents organizations from undertaking the process improvement initiatives that could lead to lasting productivity improvement. [46, 47]

5.8 Simulation Of Recommended Policies

Three simulations are depicted: response of an incapacitated system, capacity constrained system, governed by current resourcing policies and a system with recommended policies in place. Implemented recommendations included: reduction of time to adjust workforce from 52 weeks to 26 weeks, reduction of time to credential providers from 23 weeks to 12, reducing maximum patient load requirement to 60 patients.

Figure 16 shows the buildup of service members receiving BH treatment as a result of the demand surge used in earlier simulations. Recommended policies contribute to significantly lower average treatment times of service members in direct care, largely driven by higher recovery rates of treated population.

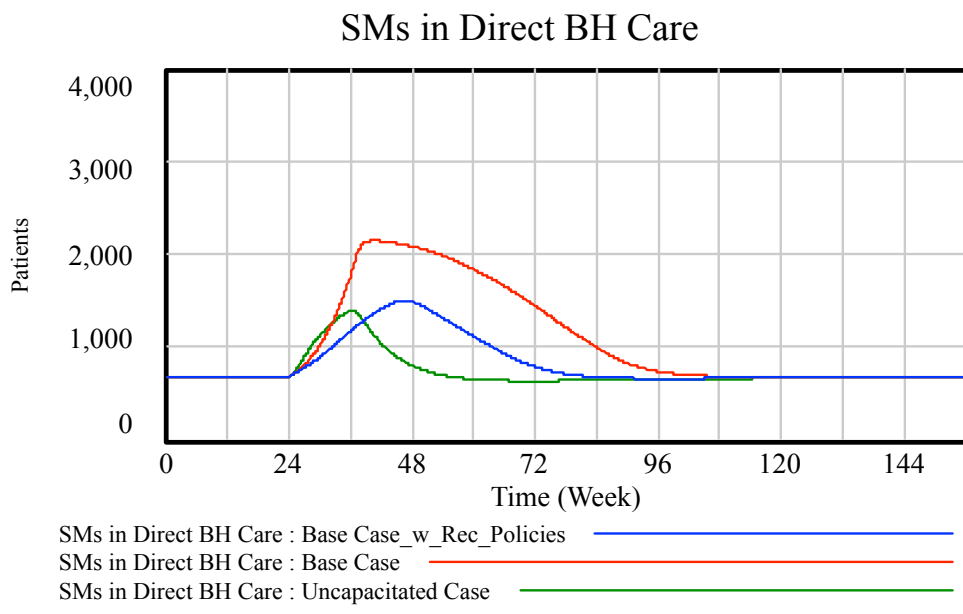


Figure 16 - System Response To Demand Surge: Impact of Recommended Policies On Treatment Effectiveness

Figure 17 depicts the number of behavioral health encounters per year, as a proxy for mental health care costs. As evident from the graph, implementation of recommended policies substantially reduce the number of yearly encounters due to improved effectiveness of treatment provided.

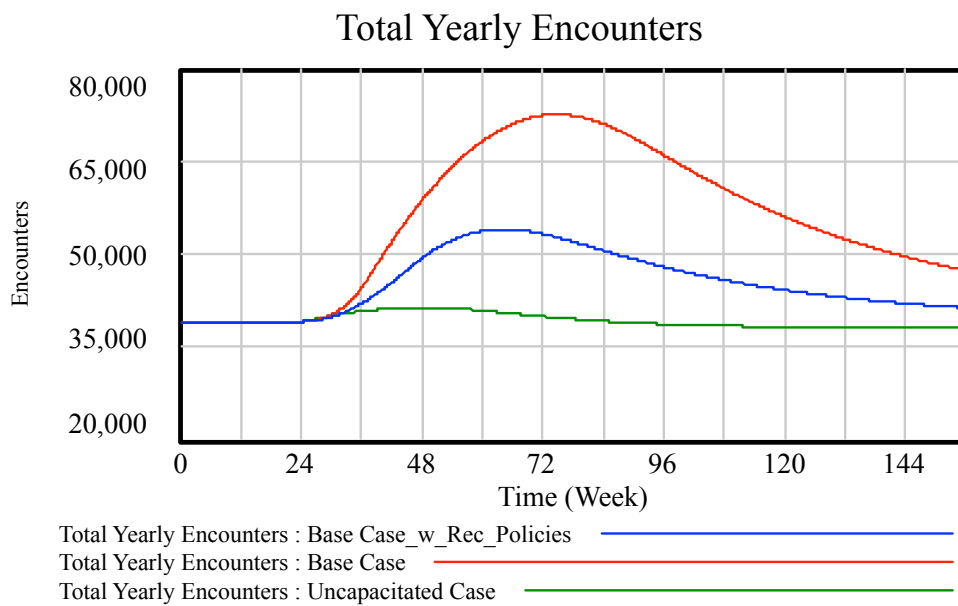


Figure 17 - System Response To Demand Surge: Impact of Policy Recommendation on Costs

Additionally figure 18 shows estimated number of yearly suicides as a function of suicide fractions, which vary, based on service members' health and treatment status, i.e. healthy, suffering from behavioral health and not in treatment, in active treatment. It is evident from the graph that recommended policies that shift the emphasis of providers towards providing higher quality care to existing patients reverses the vicious cycles that result in eventual increase in number of yearly suicides due to higher treatment drop outs and prolonged stays in treatment.

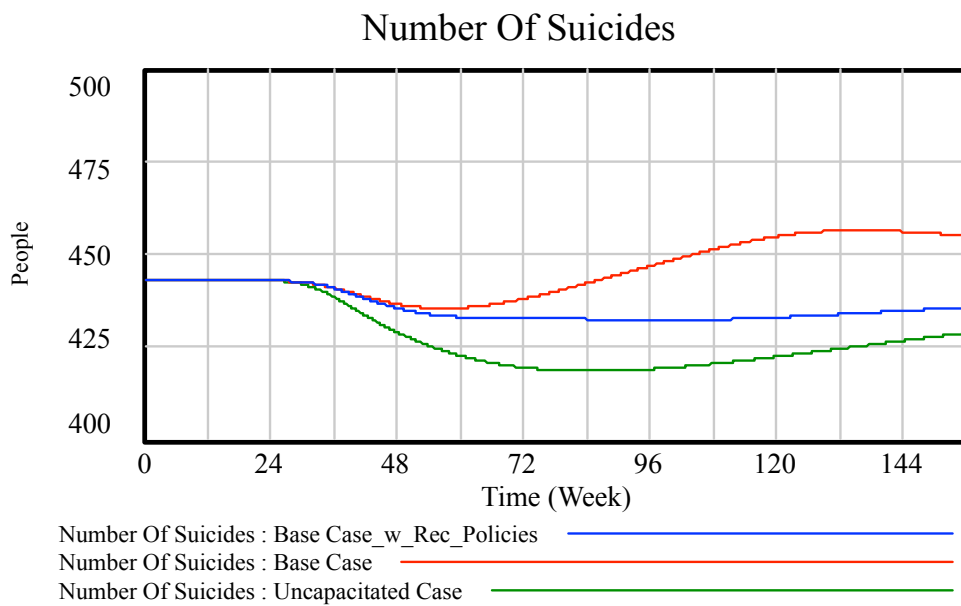


Figure 18 - System Response To The Demand Surge: Impact of Policy Recommendations On Number Of Yearly Suicides

In order to test robustness of our recommendations we conducted sensitivity analysis by varying the impact of the increase in time between therapy appointment as well as fatigue and inexperience of providers on recovery rates. Additionally we varied the impact of provider apathy, treatment effectiveness, access and treatment waiting times on attractiveness of care on attrition and referral rates. The graphs below show results of 1000 Monte Carlo simulations with different realization of the recovery fraction and attractiveness of care sensitivities.

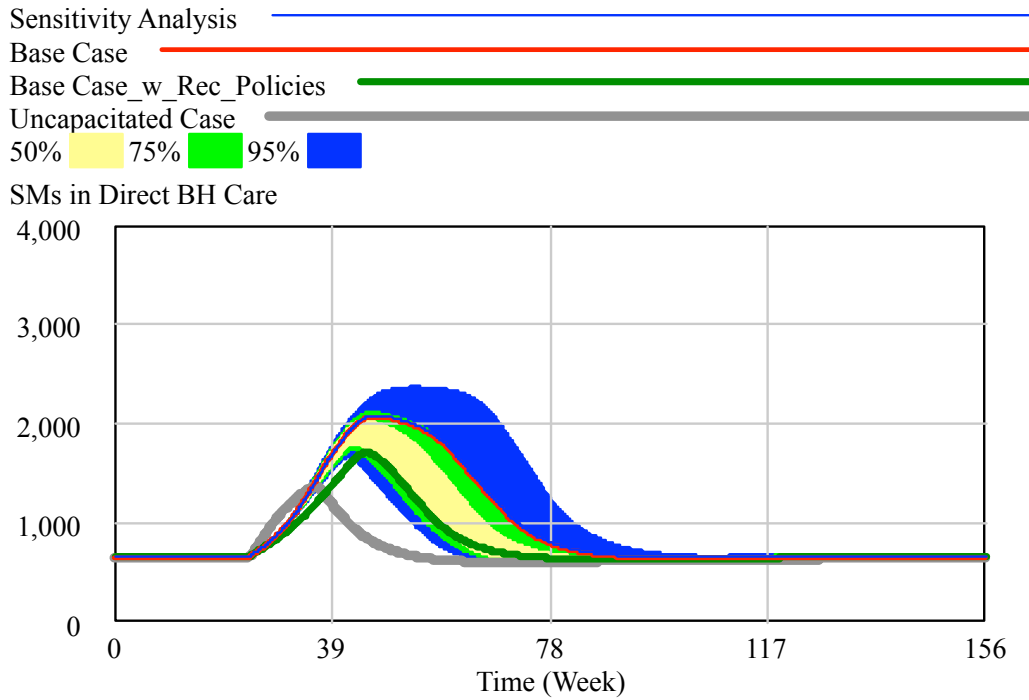


Figure 19 - Scenario Analysis: Impact On Treatment Effectiveness

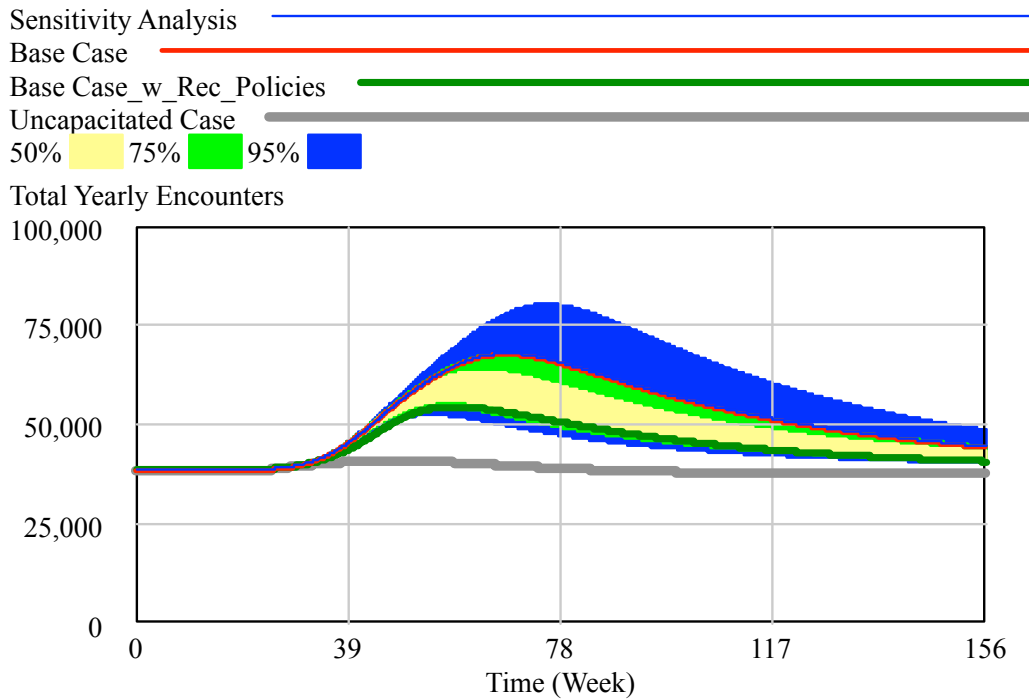


Figure 20 - Scenario Analysis: Impact On Costs

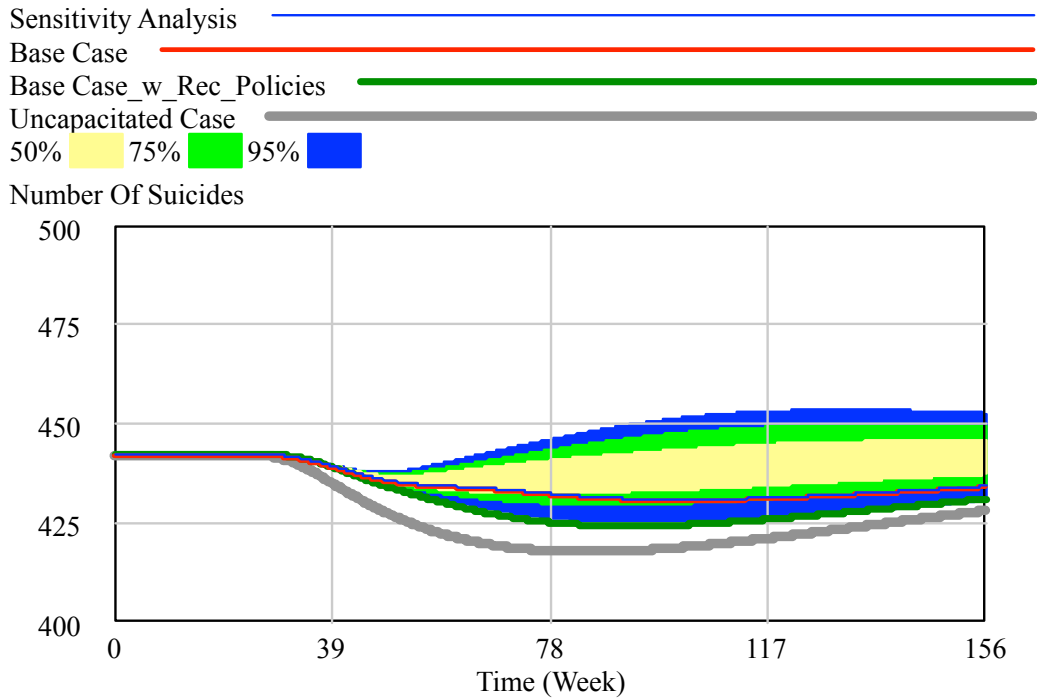


Figure 21 – Scenario Analysis: Impact on Number Of Yearly Suicides

6 Conclusion

In this work we addressed the problem of persistent provider shortage, increasing number of behavioral health encounters and high negative healthcare outcomes in military behavioral health clinics. In particular we were interested in studying how current resourcing policies and incentive structures contribute to clinics' ability to provide quality care in the environment of tight budgets and frequent demand surges. Based on interviews of key stakeholders, review of relevant empirical research and official policy documents we developed a stylized system dynamics model that captures the flow of service members through the system of behavioral health care while stationed on military bases. Our work revealed that current policies of emphasizing resource utilization and improvement of access to initial care, coupled with hiring budgets that do not account for unmet demand and plagued with prolonged delays, could trigger vicious cycles of increasing treatment

times, provider burnout, decreasing recovery rates and chronic provider shortages. We argue that these dynamics are responsible for surging healthcare costs and persistently high negative health care outcomes. Based on these findings we proposed a set of policy recommendations which if implemented have the potential of reversing current trends and contribute to a more effective utilization of limited resources and a reduction of negative health care outcomes.

7 Future Work

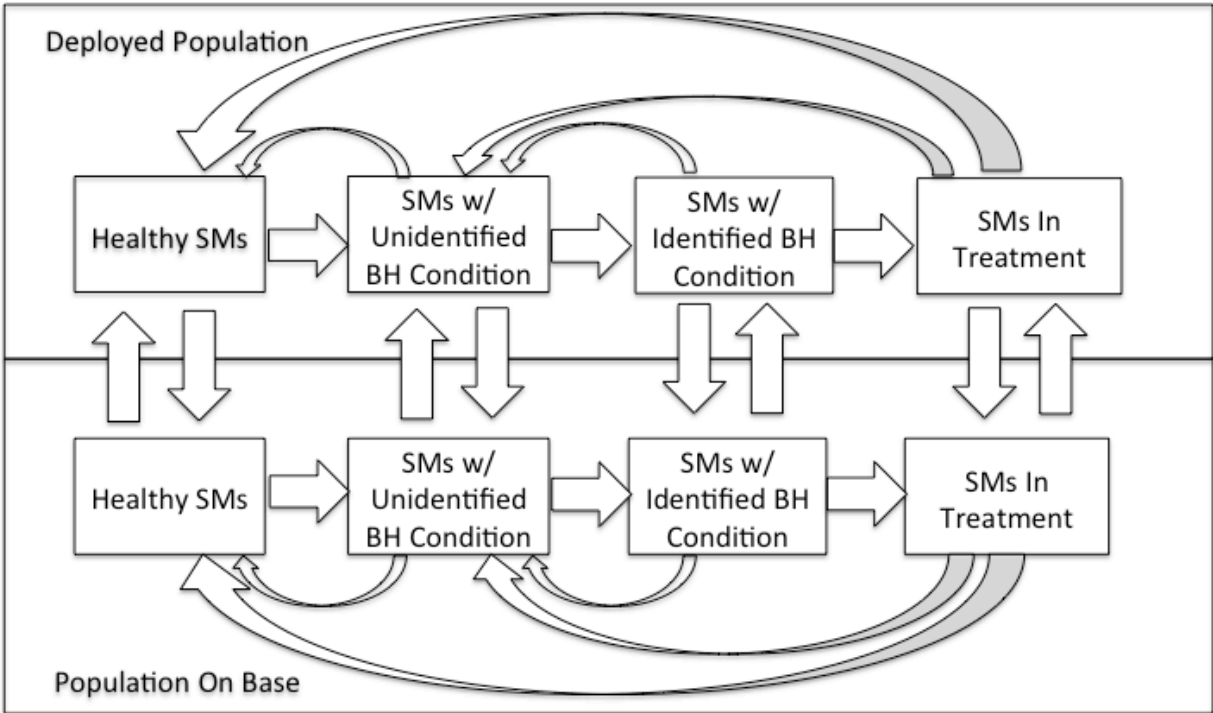
This work lays the foundation for further research aimed at tackling the challenge of devising policies and supporting performance measures that enable military behavioral health clinics provide quality mental health care to a growing military population in need. The model developed in this thesis can be easily extended and calibrated once relevant data on patient encounters and clinic operations becomes available. Calibration of the model must address assumptions and limitations noted in section 5.4 of this thesis. Special attention should be paid to validation of behavioral parameters of the model: namely the impact of workloads on provider behavior (productivity, apathy, treatment effectiveness, turnover etc.) as well as response of patients to changes in the attractiveness of care (waiting times, treatment effectiveness, provider patient alliance, etc.)

Once calibrated, future researchers can use this model to capture dynamic impact of various policy recommendations as military health system prepares to implement initiatives aimed at improving effectiveness of mental health care provision at military treatment facilities. Future work can explore the dynamics of changing deployment and demand patterns and their impact on clinics

performance as more of our service members come back from prolonged deployments. Future work can also look at the interdependencies between care provided on military bases and care provided in theatre. The role of mental health care stigma on patient seeking behavior as well as intended and unintended consequence of stigma reduction campaigns could also prove to be a fruitful and important area of research.

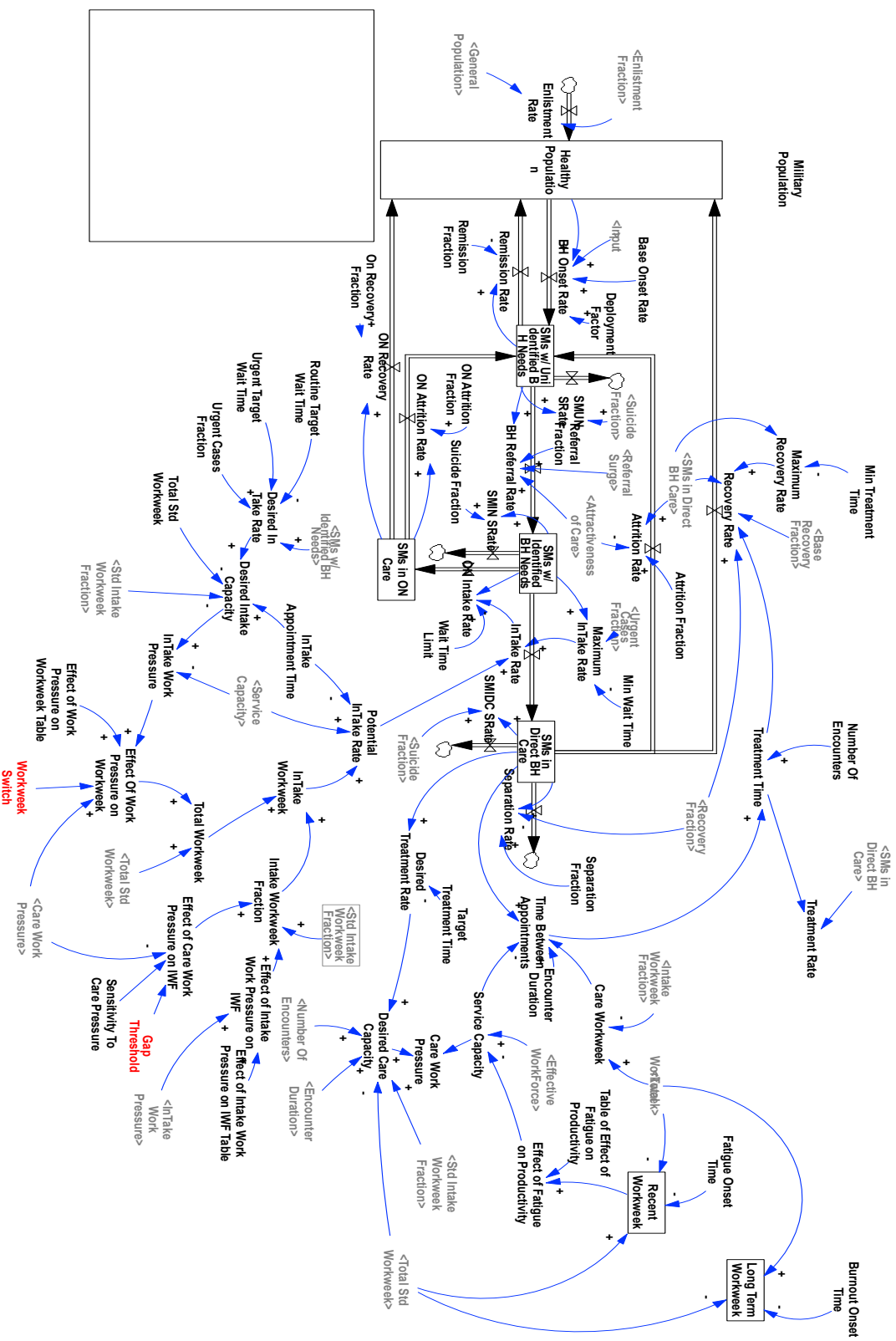
8 Appendix

8.1 The flow of service members through the system of care in theatre and on base

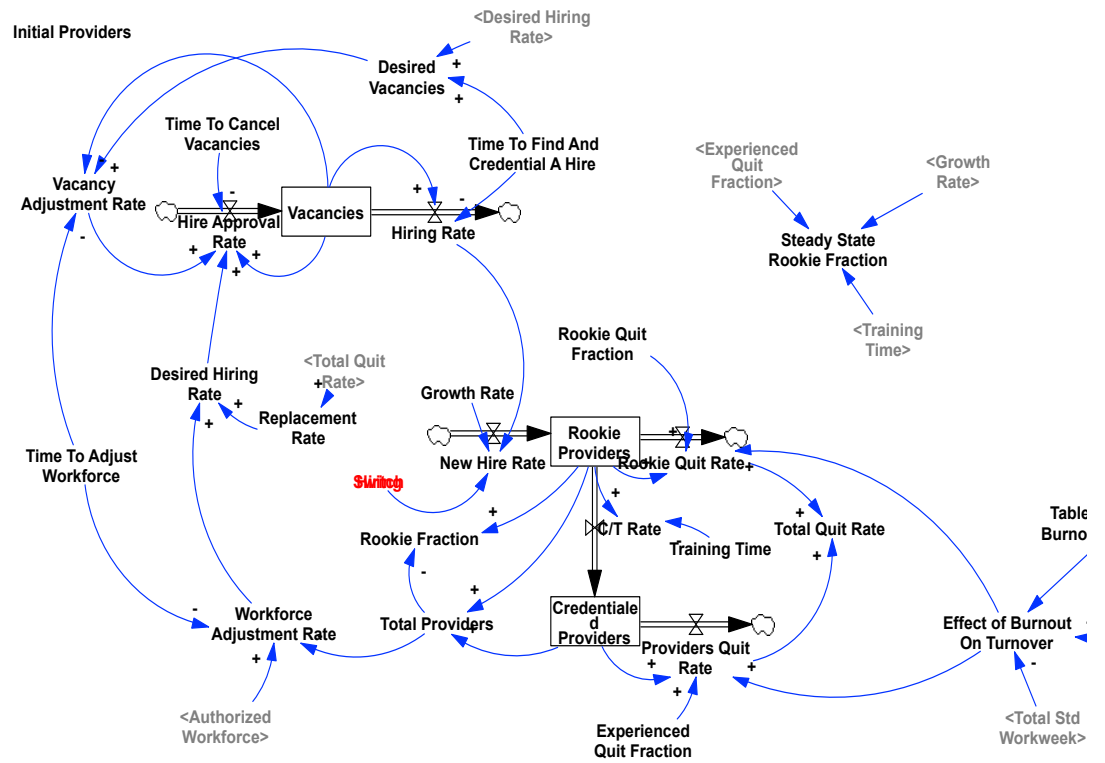


8.2 Model Snapshots

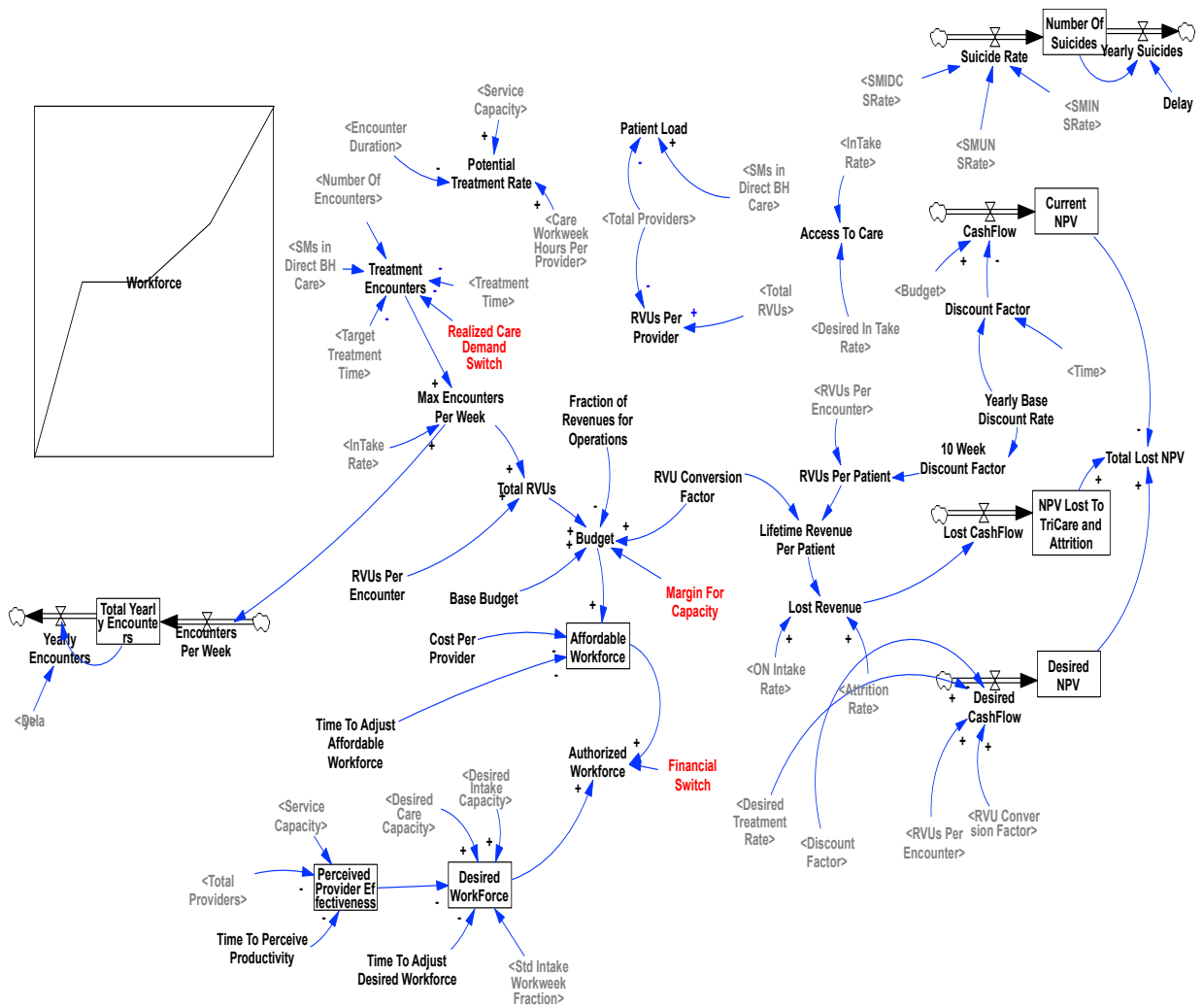
8.2.2 Simplified Demand Flow (Excludes In-Theatre Care Cycle)



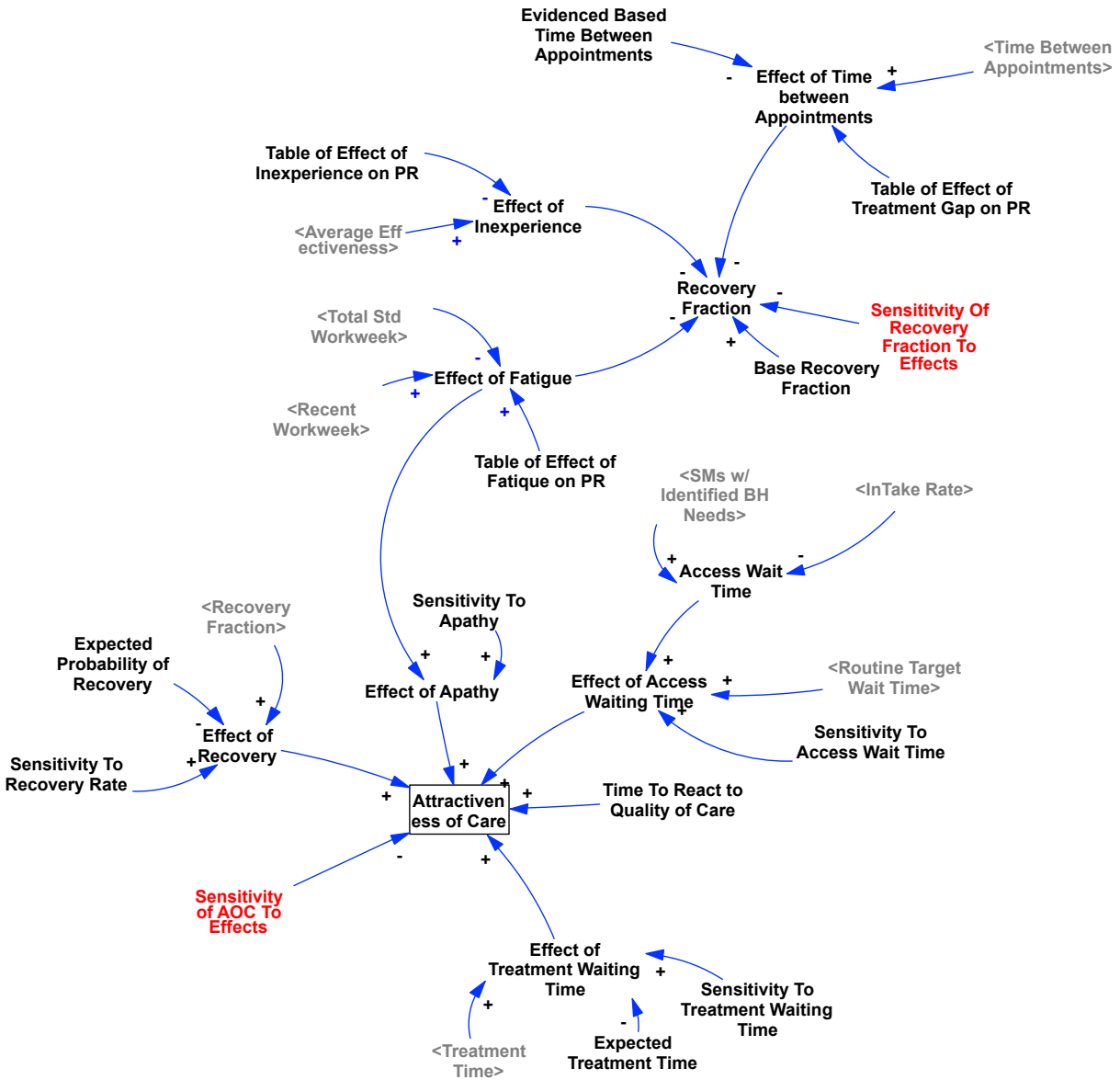
8.2.3 Workforce Acquisition Process



8.2.4 Demand Based Budget Calculation



8.2.5 Impact on Recovery Fraction and Attractiveness of Care



8.3 Model Documentation and Equations

(001) "10 Week Discount Factor" = $(1 + \text{Yearly Base Discount Rate})^{-1} + (1 + \text{Yearly Base Discount Rate})^{-2} + (1 + \text{Yearly Base Discount Rate})^{-3} + (1 + \text{Yearly Base Discount Rate})^{-4} + (1 + \text{Yearly Base Discount Rate})^{-5} + (1 + \text{Yearly Base Discount Rate})^{-6} + (1 + \text{Yearly Base Discount Rate})^{-7} + (1 + \text{Yearly Base Discount Rate})^{-8} + (1 + \text{Yearly Base Discount Rate})^{-9} + (1 + \text{Yearly Base Discount Rate})^{-10}$

Units: Dimensionless

The sum of discount factors for a 10 week period.

Used by:

(138) RVUs Per Patient

(002) Access To Care = IF THEN ELSE (Desired In Take Rate <> 0, InTake Rate / Desired In Take Rate , 1)

Units: Dimensionless

Percentage of service members able to get the appointment within the access to care standards (24 hours for accute, 7 days for routine appointments)

(003) Access Wait Time = "SMs w/ Identified BH Needs" / InTake Rate

Units: weeks

Used by:

(040) Effect of Access Waiting Time

(004) "Adjustment Time for Std. IWF" = 4

Units: Week

Used by:

(024) Change In Std. IWF

(005) Affordable Workforce = SMOOTH (Budget / Cost Per Provider , Time To Adjust Affordable Workforce)

Units: Providers

Number of providers that is possible based on the budget.

Used by:

(009) Authorized Workforce - Based on the number of providers desired adjusted for budget constraints.

(006) Attractiveness of Care = SMOOTH ((Effect of Apathy * Effect of Recovery * Effect of Treatment Waiting Time * Effect of Access Waiting Time) ^ Sensitivity of AOC To Effects , Time To React to Quality of Care)

Units: Dimensionless

Attractiveness of Care is determined by several key factors (access and recovery waiting time and apathy of providers). This variable is modulated by the sensitivity variable.

Used by:

(008) Attrition Rate - Based on the fraction of service members that drop out of care prematurely before recovering from behavioral health condition.

(016) BH Referral Rate - The number of service members that are referred to BH care on a weekly basis. Based on the referral rate composed of PDHA, PDHRA and self referrals.

(007) Attrition Fraction = $0.4 / 52$

Units: 1/Week

A fraction of service members that drop out of behavioral health care before receiving a full course of treatment.

Used by:

(155) SMs in Direct BH Care - Total number of service members in direct care at any time is based on integration of inflows and outflows from this stock.

(160) Std Intake Workweek Fraction

(008) Attrition Rate - Based on the fraction of service members that drop out of care prematurely before recovering from behavioral health condition.

(008) Attrition Rate = $SMs \text{ in Direct BH Care} * \text{Attrition Fraction} * 1 / \text{Attractiveness of Care}$

Units: Patients/Week

Based on the fraction of service members that drop out of care prematurely before recovering from behavioral health condition.

Used by:

(155) SMs in Direct BH Care - Total number of service members in direct care at any time is based on integration of inflows and outflows from this stock.

(158) SMs w/ Unidentified BH Needs - Based on the inflow of service members afflicted with behavioral health conditions, as well as those that drop out of care prematurely.

(011) Average Time in Direct Care

(088) Lost Revenue

(162) Step Height - Height of step input to customer orders, as fraction of initial value.

(009) Authorized Workforce = IF THEN ELSE (Financial Switch = 1, Min (Affordable Workforce , Desired WorkForce) , Desired WorkForce)

Units: Providers

Based on the number of providers desired adjusted for budget constraints.

Used by:

(202) Workforce Adjustment Rate - Based on the difference between total number of providers and the number of providers authorized based on capacity requirements and budget constraints.

(010) Average Effectiveness = $\text{Effective WorkForce} / \text{Total Providers}$

Units: **undefined**

Used by:

(047) Effect of Inexperience

(011) Average Time in Direct Care = $SMs \text{ in Direct BH Care} / (\text{Attrition Rate} + \text{Recovery Rate} + \text{Separation Rate} + \text{SMIDC SRate})$

Units: weeks

(012) Base Budget = INITIAL(Total Providers * Cost Per Provider - Fraction of Revenues for Operations * Total RVUs * RVU Conversion Factor)

Units: \$/Week

Base Budget

Used by:

(017) Budget - Total Budget is based on the base budget plus the RVU based calculation for the total population served.

(013) Base Onset Rate = 1

Units: 1/Week

Used by:

(015) BH Onset Rate

(014) Base Recovery Fraction = 0.8

Units: Dimensionless

Used by:

(155) SMS in Direct BH Care - Total number of service members in direct care at any time is based on integration of inflows and outflows from this stock.

(160) Std Intake Workweek Fraction

(123) Recovery Fraction - Recovery Fraction is assumed to be 0.8 subject to several key effects (fatigue, inexperience, time between follow up appointments) as well as sensitivity of the fraction to these factors.

(124) Recovery Rate - Recovery Rate represent the number of patients that recover from behavioral health condition as deemed by the providers. It is based on the number of patients in direct care treatment, the time it takes for a person to get necessary treatment and the probability of recovery based given the service member received the needed treatment.

(015) BH Onset Rate = Healthy Population * Base Onset Rate * (1 + Deployment Factor) * Input

Units: Patients/Week

Used by:

(072) Healthy Population

(158) SMS w/ Unidentified BH Needs - Based on the inflow of service members afflicted with behavioral health conditions, as well as those that drop out of care prematurely.

(016) BH Referral Rate = IF THEN ELSE (Referral Surge <> 0, Referral Surge , "SMS w/ Unidentified BH Needs" * Referral Fraction * Attractiveness of Care)

Units: People/Week

The number of service members that are referred to BH care on a weekly basis. Based on the referral rate composed of PDHA, PDHRA and self referrals.

Used by:

(157) SMS w/ Identified BH Needs - Accumulation of service members with identified behavioral health needs.

(158) SMS w/ Unidentified BH Needs - Based on the inflow of service members afflicted with behavioral health conditions, as well as those that drop out of care prematurely.

(162) Step Height - Height of step input to customer orders, as fraction of initial value.

(017) $\text{Budget} = \text{Base Budget} + \text{RVU Conversion Factor} * \text{Total RVUs} * (1 - \text{Fraction of Revenues for Operations}) * \text{Margin For Capacity}$

Units: \$/Week

Total Budget is based on the base budget plus the RVU based calculation for the total population served.

Used by:

(005) Affordable Workforce - Number of providers that is possible based on the budget.

(022) CashFlow

(018) $\text{Burnout Onset Time} = 52$

Units: weeks

Average time it takes for the burnout to set in.

Used by:

(086) Long Term Workweek - Exponential smoothing of the total workweek over the period of burnout onset.

(019) $\text{"C/T Rate"} = \text{Rookie Providers} / \text{Training Time}$

Units: Providers/Week

The rate at which providers get credentialed and trained.

Used by:

(026) Credentialed Providers - The number of credentialed providers capable to be 100% productive.

(132) Rookie Providers - The number of providers that are considered rookies, i.e. new hires not assimilated yet to the military culture, current IT systems, processes, etc.

(020) $\text{Care Work Pressure} = \text{Desired Care Capacity} / \text{Service Capacity}$

Units: Dimensionless

Measures the difference between current care capacity and capacity desired to care for existing patients.

Used by:

(043) Effect of Care Work Pressure on IWF

(053) Effect Of Work Pressure on Workweek

(021) $\text{Care Workweek Hours Per Provider} = \text{Total Workweek} * (1 - \text{Intake Workweek Fraction})$

Units: Hours/Week

Based on the total number of hours providers work and the fraction of the week dedicated to intake appointments.

Used by:

(113) Potential Treatment Rate - Based on the number of available providers, number of hours they can dedicate to treatment of patients and the duration of a typical therapy encounter.

(175) Time Between Appointments - Time between appointments is defined as the number of days between each therapy encounter. The minimum time between appointments is 1 week. However the waiting time between appointment can grow based on the capacity constraints. In this case capacity constraints are defined by the ratio between the number of SMs in direct BH care and capacity (number of patients that can be served in any given week)

(022) $\text{CashFlow} = \text{Budget} * \text{Discount Factor}$

Units: \$/Week

Used by:

(027) Current NPV

(023) Change in Pink Noise = (White Noise - Pink Noise) / Noise Correlation Time

Units: 1/Week

Change in the pink noise value; Pink noise is a first order exponential smoothing delay of the white noise input.

Used by:

(111) Pink Noise - Pink Noise is first-order autocorrelated noise. Pink noise provides a realistic noise input to models in which the next random shock depends in part on the previous shocks. The user can specify the correlation time. The mean is 0 and the standard deviation is specified by the user.

(024) "Change In Std. IWF" = (Intake Workweek Fraction - Std Intake Workweek Fraction) / "Adjustment Time for Std. IWF"

Units: Dimensionless/Week

Used by:

(160) Std Intake Workweek Fraction

(025) Cost Per Provider = 80000 / 52

Units: \$/(Week*Provider)

Cost per provider is based on a \$60,000 yearly salary (a typical salary for a military psychologist)

Used by:

(005) Affordable Workforce - Number of providers that is possible based on the budget.

(012) Base Budget - Base Budget

(026) Credentialed Providers = INTEG("C/T Rate" - Providers Quit Rate , Initial Providers * (1 - Steady State Rookie Fraction))

Units: Providers

The number of credentialed providers capable to be 100% productive.

Used by:

(055) Effective WorkForce - Defined by the number of total providers, accounting for lower productivity of newly hired providers.

(114) Providers Quit Rate - The number of credentialed providers that quit or transfer away from the clinic on a weekly basis.

(186) Total Providers - Total number of providers

(027) Current NPV = INTEG(CashFlow , 0)

Units: **undefined**

Used by:

(185) Total Lost NPV

(028) Delay = 52

Units: weeks

Used by:

(103) Number Of Suicides - Total Number of Suicides across the simulation period.

(191) Total Yearly Encounters

(205) Yearly Encounters

(206) Yearly Suicides

(029) Deployment Factor = 0

Units: Dimensionless

Deployment factor describes the impact deployment related factors have on the onset of severe behavioral health conditions among service members returning from theatre. Intensity and duration of deployments are implicit in this factor.

Used by:

(015) BH Onset Rate

(030) Desired Care Capacity = $\text{Max} (0, \text{Desired Treatment Rate} * \text{Number Of Encounters} * \text{Encounter Duration} / (\text{Total Std Workweek} * (1 - \text{Std Intake Workweek Fraction})))$

Units: Providers

Defined by the desired number of patients that receive full course of treatment per week, therapy duration and the number of workweek hours providers dedicate to care treatments.

Used by:

(020) Care Work Pressure - Measures the difference between current care capacity and capacity desired to care for existing patients.

(038) Desired WorkForce - Based on needed number of providers to meet access to care and evidence based practice standards, adjusted by the management's perception of provider effectiveness/productivity.

(031) Desired CashFlow = $(\text{Desired Treatment Rate} * 10) * \text{RVUs Per Encounter} * \text{RVU Conversion Factor} * \text{Discount Factor}$

Units: \$/Week

Used by:

(035) Desired NPV

(032) Desired Hiring Rate = Workforce Adjustment Rate + Replacement Rate

Units: Providers/Week

Used by:

(037) Desired Vacancies

(073) Hire Approval Rate - Based on desired hiring rate plus any adjustment to the vacancies based on current listing as compared to what is desired. The MAX function ensures that more vacancies than are currently in the stock cannot be canceled.

(033) Desired In Take Rate = $\text{"SMs w/ Identified BH Needs"} * (1 - \text{Urgent Cases Fraction}) / \text{Routine Target Wait Time} + \text{"SMs w/ Identified BH Needs"} * \text{Urgent Cases Fraction} / \text{Urgent Target Wait Time}$

Units: Patients/Week

Desired In-Take Rate is based on the target wait time of patients for their in-take appointments. The target wait times are based on Access To Care standards for routine mental care appointments. The target wait time for urgent care is 1/7 of that of a standard routing mental care, i.e. 1 day.

Used by:

(002) Access To Care - Percentage of service members able to get the appointment within the access to care standards (24 hours for acute, 7 days for routine appointments)

(034) Desired Intake Capacity - Is based on desired in-take rate (that meets access to care standards), the time it takes to complete a standard in-take appointment and the standard number of weekly hours required by each provider to dedicated for in-take appointments.

(034) Desired Intake Capacity = $\text{Max} (0, \text{Desired In Take Rate} * \text{InTake Appointment Time} / (\text{Total Std Workweek} * \text{Std Intake Workweek Fraction}))$

Units: Providers

Is based on desired in-take rate (that meets access to care standards), the time it takes to complete a standard in-take appointment and the standard number of weekly hours required by each provider to dedicated for in-take appointments.

Used by:

(038) Desired WorkForce - Based on needed number of providers to meet access to care and evidence based practice standards, adjusted by the management's perception of provider effectiveness/productivity.

(082) InTake Work Pressure - Based on the difference between desired intake capacity and current.

(035) Desired NPV = $\text{INTEG}(\text{Desired CashFlow}, 0)$

Units: \$

Used by:

(185) Total Lost NPV

(036) Desired Treatment Rate = $\text{SMs in Direct BH Care} / \text{Target Treatment Time}$

Units: Patients/Week

Desired Recovery rate is based on the target treatment time (based on clinical practice guidelines on the frequency and time between therapy appointments), probability of recovery and the number of service members in direct care treatment.

Used by:

(030) Desired Care Capacity - Defined by the desired number of patients that receive full course of treatment per week, therapy duration and the number of workweek hours providers dedicate to care treatments.

(031) Desired CashFlow

(037) Desired Vacancies = $\text{Desired Hiring Rate} * \text{Time To Find And Credential A Hire}$

Units: Providers

Used by:

(198) Vacancies - The number of Vacancies for providers at any given time is based on the net of hire approval rate and hiring rate of providers.

(199) Vacancy Adjustment Rate

(038) Desired WorkForce = $\text{SMOOTH} ((\text{Desired Care Capacity} * (1 - \text{Std Intake Workweek Fraction}) + \text{Desired Intake Capacity} * \text{Std Intake Workweek Fraction}) / \text{Perceived Provider Effectiveness}, \text{Time To Adjust Desired Workforce})$

Units: Providers

Based on needed number of providers to meet access to care and evidence based practice standards, adjusted by the management's perception of provider effectiveness/productivity.

Used by:

(009) Authorized Workforce - Based on the number of providers desired adjusted for budget constraints.

(039) Discount Factor = $(1 + \text{Yearly Base Discount Rate} / (52 * 8)) ^ - \text{Time}$

Units: Dimensionless

Used by:

(022) CashFlow

(031) Desired CashFlow

(040) Effect of Access Waiting Time = IF THEN ELSE (Access Wait Time <> 0, (Routine Target Wait Time / Access Wait Time) ^ Sensitivity To Access Wait Time , 1)

Units: Dimensionless

Used by:

(006) Attractiveness of Care - Attractiveness of Care is determined by several key factors (access and recovery waiting time and apathy of providers). This variable is modulated by the sensitivity variable.

(041) Effect of Apathy = Effect of Fatigue ^ Sensitivity To Apathy

Units: **undefined**

Used by:

(006) Attractiveness of Care - Attractiveness of Care is determined by several key factors (access and recovery waiting time and apathy of providers). This variable is modulated by the sensitivity variable.

(042) Effect of Burnout On Turnover = Table For Effect Of Burnout on Turnover (Long Term Workweek / Total Std Workweek)

Units: Dimensionless

The effect of burnout is driven proportional to long term workweek relative to total standard workweek.

Used by:

(114) Providers Quit Rate - The number of credentialed providers that quit or transfer away from the clinic on a weekly basis.

(134) Rookie Quit Rate - Determines the rate at which rookie providers quite the service.

(043) Effect of Care Work Pressure on IWF = IF THEN ELSE (Care Work Pressure < 1.01, 1, 1 / (1 + exp (- Gap Threshold) * exp (Care Work Pressure)) ^ Sensitivity To Care Pressure)

Units: **undefined**

Used by:

(083) Intake Workweek Fraction

(044) Effect of Care Work Pressure on IWF Table ([(0,0)-(5,1.25)],(0,1),(0.5,1),(1,1),(1.5,1),(2,0.98),(2.5,0.9),(3,0.5),(3.5,0.1),(4,0.02),(4.5,0.001))

Units: **undefined**

(045) Effect of Fatigue = Table of Effect of Fatigue on PR (Recent Workweek / Total Std Workweek)

Units: **undefined**

Used by:

(041) Effect of Apathy

(123) Recovery Fraction - Recovery Fraction is assumed to be 0.8 subject to several key effects (fatigue, inexperience, time between follow up appointments) as well as sensitivity of the fraction to these factors.

(046) Effect of Fatigue on Productivity = Table of Effect of Fatigue on Productivity (Recent Workweek)

Units: **undefined**

Used by:

(150) Service Capacity

(047) Effect of Inexperience = Table of Effect of Inexperience on PR (Average Effectiveness)

Units: Dimensionless

Used by:

(123) Recovery Fraction - Recovery Fraction is assumed to be 0.8 subject to several key effects (fatigue, inexperience, time between follow up appointments) as well as sensitivity of the fraction to these factors.

(048) Effect of Intake Work Pressure on IWF = Effect of Intake Work Pressure on IWF Table (InTake Work Pressure)

Units: Dimensionless

Used by:

(083) Intake Workweek Fraction

(049) Effect of Intake Work Pressure on IWF Table ([(0,0.7)-(3,1.25)],(0,0.75),(0.25,0.79),(0.5,0.84),(0.75,0.9),(1,1),(1.25,1.09),(1.5,1.17),(1.75,1.23),(2,1.25),(2.25,1.25))

Units: **undefined**

Effect of Intake Work Pressure On Intake Workweek Fraction

Used by:

(048) Effect of Intake Work Pressure on IWF

(050) Effect of Recovery = (Recovery Fraction / Expected Probability of Recovery) ^ Sensitivity To Recovery Rate

Units: Dimensionless

Used by:

(006) Attractiveness of Care - Attractiveness of Care is determined by several key factors (access and recovery waiting time and apathy of providers). This variable is modulated by the sensitivity variable.

(051) Effect of Time between Appointments = Table of Effect of Treatment Gap on PR (Time Between Appointments / Evidenced Based Time Between Appointments)

Units: **undefined**

Used by:

(123) Recovery Fraction - Recovery Fraction is assumed to be 0.8 subject to several key effects (fatigue, inexperience, time between follow up appointments) as well as sensitivity of the fraction to these factors.

(052) Effect of Treatment Waiting Time = (Expected Treatment Time / Treatment Time) ^ Sensitivity To Treatment Waiting Time

Units: Dimensionless

Used by:

(006) Attractiveness of Care - Attractiveness of Care is determined by several key factors (access and recovery waiting time and apathy of providers). This variable is modulated by the sensitivity variable.

(053) Effect Of Work Pressure on Workweek = IF THEN ELSE (Workweek Switch = 1, Effect of Work Pressure on Workweek Table (Max (InTake Work Pressure , Care Work Pressure)) , 1)

Units: Dimensionless

Used by:

(190) Total Workweek - Total Workweek is a standard workweek with additional hours as a consequence of an effect of work pressure.

(054) Effect of Work Pressure on Workweek Table ([(-0.25,0)-(-10.25,1)],(-0.25,0.75),(0,0.75),(0.25,0.79),(0.5,0.84),(0.75,0.9),(1,1),(1.25,1.09),(1.5,1.17),(1.75,1.23),(2,1.25),(2.25,1.25),(2.5,1.25))

Units: Dimensionless

Effect work pressure has on workweek.

Used by:

(053) Effect Of Work Pressure on Workweek

(055) Effective WorkForce = Credentialed Providers + Rookie Providers * Rookie Productivity Fraction

Units: Providers

Defined by the number of total providers, accounting for lower productivity of newly hired providers.

Used by:

(010) Average Effectiveness

(150) Service Capacity

(056) Encounter Duration = 1

Units: Hours*Provider/Patient

A Typical duration of a psychotherapy session.

Used by:

(030) Desired Care Capacity - Defined by the desired number of patients that receive full course of treatment per week, therapy duration and the number of workweek hours providers dedicate to care treatments.

(113) Potential Treatment Rate - Based on the number of available providers, number of hours they can dedicate to treatment of patients and the duration of a typical therapy encounter.

(175) Time Between Appointments - Time between appointments is defined as the number of days between each therapy encounter. The minimum time between appointments is 1 week. However the waiting time between appointment can grow based on the capacity constraints. In this case capacity constraints are defined by the ratio between the number of SMS in direct BH care and capacity (number of patients that can be served in any given week)

(057) Encounters Per Week = Max Encounters Per Week

Units: Encounters/Week

Used by:

(191) Total Yearly Encounters

(058) Enlistment Fraction = INITIAL((Step Height * Military Population - Recovery Rate - Remission Rate) / General Population)

Units: **undefined**

Used by:

(059) Enlistment Rate

(059) Enlistment Rate = General Population * Enlistment Fraction

Units: People/Week

Used by:

(072) Healthy Population

(060) Evidenced Based Time Between Appointments = 1

Units: weeks

Used by:

(051) Effect of Time between Appointments

(061) Expected Probability of Recovery = 0.8

Units: Dimensionless

Used by:

(050) Effect of Recovery

(062) Expected Treatment Time = 7

Units: weeks

Used by:

(052) Effect of Treatment Waiting Time

(063) Experienced Quit Fraction = 0.15 / 52

Units: 1/Week

Fraction of experienced providers that either transfer to a different clinic or quit the service altogether.

Used by:

(114) Providers Quit Rate - The number of credentialed providers that quit or transfer away from the clinic on a weekly basis.

(161) Steady State Rookie Fraction - A steady state rookie fraction is used for initialization.

(064) Fatigue Onset Time = 6

- Units: weeks
Time it takes for the fatigue to set in and inversely impact productivity
Used by:
(122) Recent Workweek - Smoothed over workweek based on the differential between standard workweek and actual
- (065) FINAL TIME = 156
Units: Week
The final time for the simulation.
- (066) Financial Switch = 1
Units: **undefined**
Used by:
(009) Authorized Workforce - Based on the number of providers desired adjusted for budget constraints.
- (067) Fraction of Revenues for Operations = 0.5
Units: Dimensionless
A fraction of budget dedicated to fixed costs associated with operational expenses.
Used by:
(012) Base Budget - Base Budget
(017) Budget - Total Budget is based on the base budget plus the RVU based calculation for the total population served.
- (068) Gap Threshold = 4.2
Units: Dimensionless
A variable that determines a point at which care work pressure starts to take priority over intake work pressure. It is used to determine at which value of care work pressure, its effect on intake workweek fraction is 0.5
Used by:
(043) Effect of Care Work Pressure on IWF
- (069) General Population = 200000
Units: **undefined**
Used by:
(058) Enlistment Fraction
(059) Enlistment Rate
- (070) Growth Rate = 0
Units: **undefined**
Used by:
(097) New Hire Rate - The rate is based on the hiring rate.
(161) Steady State Rookie Fraction - A steady state rookie fraction is used for initialization.
- (071) HealthStatus : HP,SMUN,SMIN,SMIDC,SMONC

(072) Healthy Population = INTEG(Enlistment Rate + ON Recovery Rate + Recovery Rate + Remission Rate - BH Onset Rate , Military Population)

Units: Patients

Used by:

(015) BH Onset Rate

(116) Pulse Quantity - The quantity to be injected to customer orders, as a fraction of the base value of Input. For example, to pulse in a quantity equal to 50% of the current value of input, set to .50.

(073) Hire Approval Rate = Max (- Vacancies / Time To Cancel Vacancies , Desired Hiring Rate + Vacancy Adjustment Rate)

Units: Providers/Week

Based on desired hiring rate plus any adjustment to the vacancies based on current listing as compared to what is desired. The MAX function ensures that more vacancies than are currently in the stock cannot be canceled.

Used by:

(198) Vacancies - The number of Vacancies for providers at any given time is based on the net of hire approval rate and hiring rate of providers.

(074) Hiring Rate = Vacancies / Time To Find And Credential A Hire

Units: Providers/Week

The hiring rate is based on the number of vacancies(open positions) and the average time it takes to hire a provider to fill a position.

Used by:

(198) Vacancies - The number of Vacancies for providers at any given time is based on the net of hire approval rate and hiring rate of providers.

(097) New Hire Rate - The rate is based on the hiring rate.

(075) Hiring Switch = 1

Units: **undefined**

Used by:

(097) New Hire Rate - The rate is based on the hiring rate.

(076) Increased BH Onset = 0

Units: **undefined**

Used by:

(116) Pulse Quantity - The quantity to be injected to customer orders, as a fraction of the base value of Input. For example, to pulse in a quantity equal to 50% of the current value of input, set to .50.

(077) Initial Providers = 20

Units: Providers

Initial number of Providers in the clinic. Used to initialize the model.

Used by:

(026) Credentialed Providers - The number of credentialed providers capable to be 100% productive.

(132) Rookie Providers - The number of providers that are considered rookies, i.e. new hires not assimilated yet to the military culture, current IT systems, processes, etc.

(078) INITIAL TIME = 0

Units: Week

The initial time for the simulation.

Used by:

(000) Time - Internally defined simulation time.

(079) Input = STEP (Step Height , Step Time) + Pulse Quantity * PULSE (Pulse Time , Pulse Duration) + RAMP (Ramp Slope , Ramp Start Time , Ramp End Time) + Sine Amplitude * SIN (2 * 3.14159 * Time / Sine Period)

Units: Dimensionless

Input is a dimensionless variable which provides a variety of test input patterns, including a step, pulse, sine wave, and random noise.

Used by:

(015) BH Onset Rate

(080) InTake Appointment Time = 1.5

Units: Hours*Provider/Patient

Standard duration of a typical in-take appointment.

Used by:

(155) SMs in Direct BH Care - Total number of service members in direct care at any time is based on integration of inflows and outflows from this stock.

(157) SMs w/ Identified BH Needs - Accumulation of service members with identified behavioral health needs.

(158) SMs w/ Unidentified BH Needs - Based on the inflow of service members afflicted with behavioral health conditions, as well as those that drop out of care prematurely.

(160) Std Intake Workweek Fraction

(034) Desired Intake Capacity - Is based on desired in-take rate (that meets access to care standards), the time it takes to complete a standard in-take appointment and the standard number of weekly hours required by each provider to dedicated for in-take appointments.

(112) Potential InTake Rate - Potential Intake Rate is defined by the number of credentialed providers, the number of hours they can dedicate to in-take appointments and the duration of those appointments.

(081) InTake Rate = Min (Potential InTake Rate , Maximum InTake Rate)

Units: Patients/Week

Determined by the minimum of potential intake rate and maximum intake rate (based on capacity)

Used by:

(155) SMs in Direct BH Care - Total number of service members in direct care at any time is based on integration of inflows and outflows from this stock.

(157) SMs w/ Identified BH Needs - Accumulation of service members with identified behavioral health needs.

(002) Access To Care - Percentage of service members able to get the appointment within the access to care standards (24 hours for acute, 7 days for routine appointments)

- (003) Access Wait Time
- (090) Max Encounters Per Week - Calculated by adding up the number of in-take appointments and number of regular encounters per week.
- (106) ON Intake Rate
- (082) InTake Work Pressure = Desired Intake Capacity / Service Capacity
 Units: Dimensionless
 Based on the difference between desired intake capacity and current.
 Used by:
 (048) Effect of Intake Work Pressure on IWF
 (053) Effect Of Work Pressure on Workweek
- (083) Intake Workweek Fraction = Effect of Intake Work Pressure on IWF * Effect of Care Work Pressure on IWF * Std Intake Workweek Fraction
 Units: Dimensionless
 Used by:
 (021) Care Workweek Hours Per Provider - Based on the total number of hours providers work and the fraction of the week dedicated to intake appointments.
 (024) Change In Std. IWF
 (084) InTake Workweek Hours Per Provider - Total hours in a given week provider allocates for in-take appointments only
- (084) InTake Workweek Hours Per Provider = Total Workweek * Intake Workweek Fraction
 Units: Hours/Week
 Total hours in a given week provider allocates for in-take appointments only
 Used by:
 (112) Potential InTake Rate - Potential Intake Rate is defined by the number of credentialed providers, the number of hours they can dedicate to in-take appointments and the duration of those appointments.
- (085) Lifetime Revenue Per Patient = RVU Conversion Factor * RVUs Per Patient
 Units: \$/Patient
 Used by:
 (088) Lost Revenue
- (086) Long Term Workweek = SMOOTHI (Total Workweek , Burnout Onset Time , Total Std Workweek)
 Units: **undefined**
 Exponential smoothing of the total workweek over the period of burnout onset.
 Used by:
 (042) Effect of Burnout On Turnover - The effect of burnout is driven proportional to long term workweek relative to total standard workweek.
- (087) Lost CashFlow = Lost Revenue
 Units: \$/Week
 Used by:
 (101) NPV Lost To TriCare and Attrition

(088) $\text{Lost Revenue} = (\text{ON Intake Rate} + \text{Attrition Rate}) * \text{Lifetime Revenue Per Patient}$

Units: \$/Week

Used by:

(087) Lost CashFlow

(089) $\text{Margin For Capacity} = 1$

Units: **undefined**

Used by:

(017) Budget - Total Budget is based on the base budget plus the RVU based calculation for the total population served.

(090) $\text{Max Encounters Per Week} = \text{InTake Rate} + \text{Treatment Encounters}$

Units: Patients/Week

Calculated by adding up the number of in-take appointments and number of regular encounters per week.

Used by:

(057) Encounters Per Week

(188) Total RVUs - Total RVUs generated based on the number of patients served and RVUs generated per patient per episode.

(091) $\text{Maximum InTake Rate} = \frac{\text{"SMs w/ Identified BH Needs"} * \text{Urgent Cases Fraction}}{(\text{Min Wait Time} / 7) + \text{"SMs w/ Identified BH Needs"} * (1 - \text{Urgent Cases Fraction}) / \text{Min Wait Time}}$

Units: Patients/Week

Determined by all those seeking appointment able to get them within 24 hours.

Used by:

(081) InTake Rate - Determined by the minimum of potential intake rate and maximum intake rate (based on capacity)

(092) $\text{Maximum Recovery Rate} = \frac{\text{SMs in Direct BH Care}}{\text{Min Treatment Time}}$

Units: Patients/Week

Minimum Treatment rate is dependent on the minimum time it takes to get treated and the number of service members in direct care.

Used by:

(124) Recovery Rate - Recovery Rate represent the number of patients that recover from behavioral health condition as deemed by the providers. It is based on the number of patients in direct care treatment, the time it takes for a person to get necessary treatment and the probability of recovery based given the service member received the needed treatment.

(093) $\text{Military Population} = 20000$

Units: People

Population of service members at a given Military Base.

Used by:

(072) Healthy Population

(058) Enlistment Fraction

(162) Step Height - Height of step input to customer orders, as fraction of initial value.

- (094) Min Treatment Time = 7
 Units: weeks
 Corresponds to the minimum time it takes a service member to go through the full course of treatment
 Used by:
 (092) Maximum Recovery Rate - Minimum Treatment rate is dependent on the minimum time it takes to get treated and the number of service members in direct care.
- (095) Min Treatment Wait Time = 1
 Units: Week
- (096) Min Wait Time = 1
 Units: weeks
 Minimum wait time is one day.
 Used by:
 (091) Maximum InTake Rate - Determined by all those seeking appointment able to get them within 24 hours.
- (097) New Hire Rate = IF THEN ELSE (Hiring Switch = 1, Hiring Rate + Growth Rate , 0)
 Units: Providers/Week
 The rate is based on the hiring rate.
 Used by:
 (132) Rookie Providers - The number of providers that are considered rookies, i.e. new hires not assimilated yet to the military culture, current IT systems, processes, etc.
- (098) Noise Correlation Time = 4
 Units: Week
 The correlation time constant for Pink Noise.
 Used by:
 (023) Change in Pink Noise - Change in the pink noise value; Pink noise is a first order exponential smoothing delay of the white noise input.
 (201) White Noise - White noise input to the pink noise process.
- (099) Noise Standard Deviation = 0.1
 Units: Dimensionless
 The standard deviation of the pink noise process.
 Used by:
 (201) White Noise - White noise input to the pink noise process.
- (100) Noise Start Time = 10
 Units: Week
 Start time for the random input.
- (101) NPV Lost To TriCare and Attrition = INTEG(Lost CashFlow , 0)
 Units: \$
 Used by:
 (185) Total Lost NPV

- (102) Number Of Encounters = 7
 Units: Dimensionless
 Average number of therapy sessions/encounters for a given patient.
 Used by:
 (160) Std Intake Workweek Fraction
 (030) Desired Care Capacity - Defined by the desired number of patients that receive full course of treatment per week, therapy duration and the number of workweek hours providers dedicate to care treatments.
 (193) Treatment Encounters - Calculated either based on realized treatment rate or idealized treatment rates.
 (195) Treatment Time - Treatment time corresponds to the total amount of time it takes for an SM to get a full course of treatment, ie. number of therapy sessions times the time between each session. It is therefore found by multiplying the number of sessions and the time between sessions.
- (103) Number Of Suicides = INTEG(Suicide Rate - Yearly Suicides , Suicide Rate * Delay)
 Units: People
 Total Number of Suicides across the simulation period.
 Used by:
 (206) Yearly Suicides
- (104) ON Attrition Fraction = 0.4 / 52
 Units: **undefined**
 Used by:
 (105) ON Attrition Rate
- (105) ON Attrition Rate = SMs in ON Care * ON Attrition Fraction
 Units: People/Week
 Used by:
 (156) SMs in ON Care
 (158) SMs w/ Unidentified BH Needs - Based on the inflow of service members afflicted with behavioral health conditions, as well as those that drop out of care prematurely.
- (106) ON Intake Rate = Max (0, "SMs w/ Identified BH Needs" / Wait Time Limit - InTake Rate)
 Units: People/Week
 Used by:
 (156) SMs in ON Care
 (157) SMs w/ Identified BH Needs - Accumulation of service members with identified behavioral health needs.
 (088) Lost Revenue
- (107) On Recovery Fraction = 0.5 / 52
 Units: **undefined**
 Used by:
 (108) ON Recovery Rate
- (108) ON Recovery Rate = SMs in ON Care * On Recovery Fraction

Units: People/Week
Used by:
(072) Healthy Population
(156) SMs in ON Care

(109) Patient Load = SMs in Direct BH Care / Total Providers
Units: Patients/Provider
Patient load of each provider

(110) Perceived Provider Effectiveness = SMOOTH (Service Capacity / Total Providers , Time To Perceive Productivity)
Units: Dimensionless
A delayed perception of provider effectiveness based on past productivity.
Used by:
(038) Desired WorkForce - Based on needed number of providers to meet access to care and evidence based practice standards, adjusted by the management's perception of provider effectiveness/productivity.

(111) Pink Noise = INTEG(Change in Pink Noise , 0)
Units: Dimensionless
Pink Noise is first-order autocorrelated noise. Pink noise provides a realistic noise input to models in which the next random shock depends in part on the previous shocks. The user can specify the correlation time. The mean is 0 and the standard deviation is specified by the user.
Used by:
(023) Change in Pink Noise - Change in the pink noise value; Pink noise is a first order exponential smoothing delay of the white noise input.

(112) Potential InTake Rate = Service Capacity * InTake Workweek Hours Per Provider / InTake Appointment Time
Units: Patients/Week
Potential Intake Rate is defined by the number of credentialed providers, the number of hours they can dedicate to in-take appointments and the duration of those appointments.
Used by:
(081) InTake Rate - Determined by the minimum of potential intake rate and maximum intake rate (based on capacity)

(113) Potential Treatment Rate = Service Capacity * Care Workweek Hours Per Provider / Encounter Duration
Units: Patients/Week
Based on the number of available providers, number of hours they can dedicate to treatment of patients and the duration of a typical therapy encounter.

(114) Providers Quit Rate = Credentialed Providers * Experienced Quit Fraction * Effect of Burnout On Turnover
Units: Providers/Week
The number of credentialed providers that quit or transfer away from the clinic on a weekly basis.

Used by:

(026) Credentialed Providers - The number of credentialed providers capable to be 100% productive.

(187) Total Quit Rate - Defined as the rate of total providers quitting the service.

(115) Pulse Duration = 20

Units: Week

Duration of pulse input. Set to Time Step for an impulse.

Used by:

(079) Input - Input is a dimensionless variable which provides a variety of test input patterns, including a step, pulse, sine wave, and random noise.

(116) Pulse Quantity = Increased BH Onset / Healthy Population

Units: Week*Dimensionless

The quantity to be injected to customer orders, as a fraction of the base value of Input. For example, to pulse in a quantity equal to 50% of the current value of input, set to .50.

Used by:

(079) Input - Input is a dimensionless variable which provides a variety of test input patterns, including a step, pulse, sine wave, and random noise.

(117) Pulse Time = 12

Units: Week

Time at which the pulse in Input occurs.

Used by:

(079) Input - Input is a dimensionless variable which provides a variety of test input patterns, including a step, pulse, sine wave, and random noise.

(118) Ramp End Time = 50

Units: Week

End time for the ramp input.

Used by:

(079) Input - Input is a dimensionless variable which provides a variety of test input patterns, including a step, pulse, sine wave, and random noise.

(119) Ramp Slope = 0

Units: 1/Week

Slope of the ramp input, as a fraction of the base value (per week).

Used by:

(079) Input - Input is a dimensionless variable which provides a variety of test input patterns, including a step, pulse, sine wave, and random noise.

(120) Ramp Start Time = 30

Units: Week

Start time for the ramp input.

Used by:

(079) Input - Input is a dimensionless variable which provides a variety of test input patterns, including a step, pulse, sine wave, and random noise.

(121) Realized Care Demand Switch = 0

Units: Dimensionless

A switch used to determine how care demand budget is calculated: realized - based on actual average treatment times, ideal - based on desired average treatment time 1 - realized treatment time is used 0 - idealized treatment is used

Used by:

(193) Treatment Encounters - Calculated either based on realized treatment rate or idealized treatment rates.

(122) Recent Workweek = SMOOTHI (Total Workweek , Fatigue Onset Time , Total Std Workweek)

Units: weeks

Smoothed over workweek based on the differential between standard workweek and actual

Used by:

(045) Effect of Fatigue

(046) Effect of Fatigue on Productivity

(123) Recovery Fraction = Base Recovery Fraction * (Effect of Fatigue * Effect of Inexperience * Effect of Time between Appointments) ^ Sensitivity Of Recovery Fraction To Effects

Units: Dimensionless

Recovery Fraction is assumed to be 0.8 subject to several key effects (fatigue, inexperience, time between follow up appointments) as well as sensitivity of the fraction to these factors.

Used by:

(050) Effect of Recovery

(124) Recovery Rate - Recovery Rate represent the number of patients that recover from behavioral health condition as deemed by the providers. It is based on the number of patients in direct care treatment, the time it takes for a person to get necessary treatment and the probability of recovery based given the service member received the needed treatment.

(149) Separation Rate

(124) Recovery Rate = Min (Maximum Recovery Rate * Base Recovery Fraction , SMs in Direct BH Care * (1 / Treatment Time) * Recovery Fraction)

Units: Patients/Week

Recovery Rate represent the number of patients that recover from behavioral health condition as deemed by the providers. It is based on the number of patients in direct care treatment, the time it takes for a person to get necessary treatment and the probability of recovery based given the service member received the needed treatment.

Used by:

(072) Healthy Population

(155) SMs in Direct BH Care - Total number of service members in direct care at any time is based on integration of inflows and outflows from this stock.

(011) Average Time in Direct Care

(058) Enlistment Fraction

(125) Referral Fraction = 0.5 / 52

Units: 1/Week

Overall referral rate based on PHRA/PDHRA and self referral rates. The rate represents the proportion of service members that are referred to BH clinics on a weekly basis.

Used by:

(158) SMs w/ Unidentified BH Needs - Based on the inflow of service members afflicted with behavioral health conditions, as well as those that drop out of care prematurely.

(016) BH Referral Rate - The number of service members that are referred to BH care on a weekly basis. Based on the referral rate composed of PDHA, PDHRA and self referrals.

(126) Referral Surge = Surge Amount * PULSE (Surge Start Time , Surge Duration)

Units: **undefined**

Used by:

(016) BH Referral Rate - The number of service members that are referred to BH care on a weekly basis. Based on the referral rate composed of PDHA, PDHRA and self referrals.

(127) Remission Fraction = 0.2 / 52

Units: 1/Week

Used by:

(128) Remission Rate

(128) Remission Rate = Remission Fraction * "SMs w/ Unidentified BH Needs"

Units: Patients/Week

Used by:

(072) Healthy Population

(158) SMs w/ Unidentified BH Needs - Based on the inflow of service members afflicted with behavioral health conditions, as well as those that drop out of care prematurely.

(058) Enlistment Fraction

(162) Step Height - Height of step input to customer orders, as fraction of initial value.

(129) Replacement Rate = Total Quit Rate

Units: Providers/Week

Equivalent to the total quit rate

Used by:

(032) Desired Hiring Rate

(130) Rookie Fraction = Rookie Providers / Total Providers

Units: Dimensionless

The fraction of rookie providers

(131) Rookie Productivity Fraction = 0.1

Units: Dimensionless

Corresponds to the fraction of full productivity new hires that are not credentialed or trained can achieve.

Used by:

(055) Effective WorkForce - Defined by the number of total providers, accounting for lower productivity of newly hired providers.

(132) Rookie Providers = INTEG(New Hire Rate - "C/T Rate" - Rookie Quit Rate , Initial Providers * Steady State Rookie Fraction)

Units: Providers

The number of providers that are considered rookies, i.e. new hires not assimilated yet to the military culture, current IT systems, processes, etc.

Used by:

(019) C/T Rate - The rate at which providers get credentialed and trained.

(055) Effective WorkForce - Defined by the number of total providers, accounting for lower productivity of newly hired providers.

(130) Rookie Fraction - The fraction of rookie providers

(134) Rookie Quit Rate - Determines the rate at which rookie providers quite the service.

(186) Total Providers - Total number of providers

(133) Rookie Quit Fraction = 0 / 52

Units: 1/Week

The fraction of new providers that decide to quit the job and either transfer to a different base or quit the service all together.

Used by:

(134) Rookie Quit Rate - Determines the rate at which rookie providers quite the service.

(134) Rookie Quit Rate = Rookie Providers * Rookie Quit Fraction * Effect of Burnout On Turnover

Units: Providers/Week

Determines the rate at which rookie providers quite the service.

Used by:

(132) Rookie Providers - The number of providers that are considered rookies, i.e. new hires not assimilated yet to the military culture, current IT systems, processes, etc.

(187) Total Quit Rate - Defined as the rate of total providers quitting the service.

(135) Routine Target Wait Time = 1

Units: Week

Based on Access To care STandard for routine mental health appointment.

Used by:

(033) Desired In Take Rate - Desired In-Take Rate is based on the target wait time of patients for their in-take appointments. The target wait times are based on Access To Care standards for routine mental care appointments. The target wait time for urgent care is 1/7 of that of a standard routing mental care, i.e. 1 day.

(040) Effect of Access Waiting Time

(136) RVU Conversion Factor = 33.98

Units: \$/RVU

2011 RVU conversion factor.

Used by:

(012) Base Budget - Base Budget

(017) Budget - Total Budget is based on the base budget plus the RVU based calculation for the total population served.

(031) Desired CashFlow

(085) Lifetime Revenue Per Patient

- (137) $\text{RVUs Per Encounter} = 2.046$
 Units: RVUs/Patient
 Number of RVUs Per Encounter
 Used by:
 (031) Desired CashFlow
 (138) RVUs Per Patient
 (188) Total RVUs - Total RVUs generated based on the number of patients served and RVUs generated per patient per episode.
- (138) $\text{RVUs Per Patient} = \text{RVUs Per Encounter} * \text{"10 Week Discount Factor"}$
 Units: RVUs/Patient
 Used by:
 (085) Lifetime Revenue Per Patient
- (139) $\text{RVUs Per Provider} = \text{Total RVUs} / \text{Total Providers}$
 Units: RVUs/Provider
- (140) $\text{SAVEPER} = \text{TIME STEP}$
 Units: Week [0,?]
 The frequency with which output is stored.
- (141) $\text{Sensitivity Of Recovery Fraction To Effects} = 1$
 Units: Dimensionless
 A Variable to control sensitivity of the recovery fraction to the various negative effects, i.e. fatigue and inexperience of providers as well as increases in time between follow up appointments,
 Used by:
 (123) Recovery Fraction - Recovery Fraction is assumed to be 0.8 subject to several key effects (fatigue, inexperience, time between follow up appointments) as well as sensitivity of the fraction to these factors.
- (142) $\text{Sensitivity of AOC To Effects} = 0.2$
 Units: **undefined**
 Used by:
 (006) Attractiveness of Care - Attractiveness of Care is determined by several key factors (access and recovery waiting time and apathy of providers). This variable is modulated by the sensitivity variable.
- (143) $\text{Sensitivity To Access Wait Time} = 0.2$
 Units: **undefined**
 Used by:
 (040) Effect of Access Waiting Time
- (144) $\text{Sensitivity To Apathy} = 0.9$
 Units: **undefined**
 Used by:
 (041) Effect of Apathy

(145) Sensitivity To Care Pressure = 1

Units: **undefined**

Used by:

(043) Effect of Care Work Pressure on IWF

(146) Sensitivity To Recovery Rate = 0.3

Units: Dimensionless

Used by:

(050) Effect of Recovery

(147) Sensitivity To Treatment Waiting Time = 0.3

Units: Dimensionless

Used by:

(052) Effect of Treatment Waiting Time

(148) Separation Fraction = 0.1 / 52

Units: 1/Week

Separation Fraction corresponds to the proportion of people that are separated from the military due to severe behavioral health condition. Condition has to be deemed disabling enough to warrant separation.

Used by:

(155) SMs in Direct BH Care - Total number of service members in direct care at any time is based on integration of inflows and outflows from this stock.

(160) Std Intake Workweek Fraction

(149) Separation Rate

(149) Separation Rate = SMs in Direct BH Care * Separation Fraction * (1 - Recovery Fraction)

Units: Patients/Week

Used by:

(155) SMs in Direct BH Care - Total number of service members in direct care at any time is based on integration of inflows and outflows from this stock.

(011) Average Time in Direct Care

(150) Service Capacity = Effective WorkForce * Effect of Fatigue on Productivity

Units: Providers

Used by:

(155) SMs in Direct BH Care - Total number of service members in direct care at any time is based on integration of inflows and outflows from this stock.

(157) SMs w/ Identified BH Needs - Accumulation of service members with identified behavioral health needs.

(158) SMs w/ Unidentified BH Needs - Based on the inflow of service members afflicted with behavioral health conditions, as well as those that drop out of care prematurely.

(020) Care Work Pressure - Measures the difference between current care capacity and capacity desired to care for existing patients.

(082) InTake Work Pressure - Based on the difference between desired intake capacity and current.

(110) Perceived Provider Effectiveness - A delayed perception of provider effectiveness based on past productivity.

(112) Potential InTake Rate - Potential Intake Rate is defined by the number of credentialed providers, the number of hours they can dedicate to in-take appointments and the duration of those appointments.

(113) Potential Treatment Rate - Based on the number of available providers, number of hours they can dedicate to treatment of patients and the duration of a typical therapy encounter.

(175) Time Between Appointments - Time between appointments is defined as the number of days between each therapy encounter. The minimum time between appointments is 1 week. However the waiting time between appointment can grow based on the capacity constraints. In this case capacity constraints are defined by the ratio between the number of SMs in direct BH care and capacity (number of patients that can be served in any given week)

(151) Sine Amplitude = 0

Units: Dimensionless

Amplitude of sine wave in customer orders (fraction of mean).

Used by:

(079) Input - Input is a dimensionless variable which provides a variety of test input patterns, including a step, pulse, sine wave, and random noise.

(152) Sine Period = 52

Units: Week

Period of sine wave in customer demand. Set initially to 52 weeks to simulate an annual cycle

Used by:

(079) Input - Input is a dimensionless variable which provides a variety of test input patterns, including a step, pulse, sine wave, and random noise.

(153) SMIDC SRate = SMs in Direct BH Care * Suicide Fraction[SMIDC]

Units: Patients/Week

Used by:

(155) SMs in Direct BH Care - Total number of service members in direct care at any time is based on integration of inflows and outflows from this stock.

(011) Average Time in Direct Care

(165) Suicide Rate - Total Suicide Rates across the whole population

(154) SMIN SRate = "SMs w/ Identified BH Needs" * Suicide Fraction[SMIN]

Units: People/Week

Used by:

(157) SMs w/ Identified BH Needs - Accumulation of service members with identified behavioral health needs.

(165) Suicide Rate - Total Suicide Rates across the whole population

(155) SMs in Direct BH Care = INTEG(InTake Rate - Attrition Rate - Recovery Rate - Separation Rate - SMIDC SRate , (Service Capacity * Total Std Workweek * Std Intake Workweek Fraction / InTake Appointment Time) / (Attrition Fraction + Separation Fraction * (1 - Base Recovery Fraction) + Base Recovery Fraction / 7 + Suicide Fraction[SMIDC]))

Units: Patients

Total number of service members in direct care at any time is based on integration of inflows and outflows from this stock.

Used by:

(008) Attrition Rate - Based on the fraction of service members that drop out of care prematurely before recovering from behavioral health condition.

(011) Average Time in Direct Care

(036) Desired Treatment Rate - Desired Recovery rate is based on the target treatment time (based on clinical practice guidelines on the frequency and time between therapy appointments), probability of recovery and the number of service members in direct care treatment.

(092) Maximum Recovery Rate - Minimum Treatment rate is dependent on the minimum time it takes to get treated and the number of service members in direct care.

(109) Patient Load - Patient load of each provider

(124) Recovery Rate - Recovery Rate represent the number of patients that recover from behavioral health condition as deemed by the providers. It is based on the number of patients in direct care treatment, the time it takes for a person to get necessary treatment and the probability of recovery based given the service member received the needed treatment.

(149) Separation Rate

(153) SMIDC SRate

(175) Time Between Appointments - Time between appointments is defined as the number of days between each therapy encounter. The minimum time between appointments is 1 week. However the waiting time between appointment can grow based on the capacity constraints. In this case capacity constraints are defined by the ratio between the number of SMs in direct BH care and capacity (number of patients that can be served in any given week)

(193) Treatment Encounters - Calculated either based on realized treatment rate or idealized treatment rates.

(194) Treatment Rate

(156) SMs in ON Care = INTEG(ON Intake Rate - ON Attrition Rate - ON Recovery Rate , 0)

Units: **undefined**

Used by:

(105) ON Attrition Rate

(108) ON Recovery Rate

(157) "SMs w/ Identified BH Needs" = INTEG(BH Referral Rate - InTake Rate - ON Intake Rate - SMIN SRate , Service Capacity * Total Std Workweek * Std Intake Workweek Fraction / InTake Appointment Time)

Units: People

Accumulation of service members with identified behavioral health needs.

Used by:

(003) Access Wait Time

(033) Desired In Take Rate - Desired In-Take Rate is based on the target wait time of patients for their in-take appointments. The target wait times are based on Access To Care standards for routine mental care appointments. The target wait time for urgent care is 1/7 of that of a standard routing mental care, i.e. 1 day.

(091) Maximum InTake Rate - Determined by all those seeking appointment able to get them within 24 hours.

(106) ON Intake Rate

(154) SMIN SRate

(158) "SMs w/ Unidentified BH Needs" = $\text{INTEG}(\text{Attrition Rate} + \text{BH Onset Rate} + \text{ON Attrition Rate} - \text{BH Referral Rate} - \text{Remission Rate} - \text{SMUN SRate}, (\text{Service Capacity} * \text{Total Std Workweek} * \text{Std Intake Workweek Fraction} / \text{InTake Appointment Time} * (\text{Suicide Fraction}[\text{SMIN}] + 1)) / \text{Referral Fraction})$

Units: People

Based on the inflow of service members afflicted with behavioral health conditions, as well as those that drop out of care prematurely.

Used by:

(016) BH Referral Rate - The number of service members that are referred to BH care on a weekly basis. Based on the referral rate composed of PDHA, PDHRA and self referrals.

(128) Remission Rate

(159) SMUN SRate

(159) $\text{SMUN SRate} = \text{Suicide Fraction}[\text{SMUN}] * \text{"SMs w/ Unidentified BH Needs"}$

Units: People/Week

Used by:

(158) SMs w/ Unidentified BH Needs - Based on the inflow of service members afflicted with behavioral health conditions, as well as those that drop out of care prematurely.

(162) Step Height - Height of step input to customer orders, as fraction of initial value.

(165) Suicide Rate - Total Suicide Rates across the whole population

(160) $\text{Std Intake Workweek Fraction} = \text{INTEG}(\text{"Change In Std. IWF"}, (\text{Attrition Fraction} + \text{Separation Fraction} * (1 - \text{Base Recovery Fraction}) + \text{Base Recovery Fraction} / \text{Number Of Encounters} + \text{Suicide Fraction}[\text{SMIDC}]) / (1 / \text{InTake Appointment Time} + \text{Attrition Fraction} + \text{Separation Fraction} * (1 - \text{Base Recovery Fraction}) + \text{Base Recovery Fraction} / \text{Number Of Encounters} + \text{Suicide Fraction}[\text{SMIDC}]))$

Units: **undefined**

Used by:

(155) SMs in Direct BH Care - Total number of service members in direct care at any time is based on integration of inflows and outflows from this stock.

(157) SMs w/ Identified BH Needs - Accumulation of service members with identified behavioral health needs.

(158) SMs w/ Unidentified BH Needs - Based on the inflow of service members afflicted with behavioral health conditions, as well as those that drop out of care prematurely.

(024) Change In Std. IWF

(030) Desired Care Capacity - Defined by the desired number of patients that receive full course of treatment per week, therapy duration and the number of workweek hours providers dedicate to care treatments.

(034) Desired Intake Capacity - Is based on desired in-take rate (that meets access to care standards), the time it takes to complete a standard in-take appointment and the standard number of weekly hours required by each provider to dedicated for in-take appointments.

(038) Desired WorkForce - Based on needed number of providers to meet access to care and evidence based practice standards, adjusted by the management's perception of provider effectiveness/productivity.

(083) Intake Workweek Fraction

(161) Steady State Rookie Fraction = $\text{Training Time} * (\text{Experienced Quit Fraction} + \text{Growth Rate}) / (1 + \text{Training Time} * (\text{Experienced Quit Fraction} + \text{Growth Rate}))$

Units: Dimensionless

A steady state rookie fraction is used for initialization.

Used by:

(026) Credentialed Providers - The number of credentialed providers capable to be 100% productive.

(132) Rookie Providers - The number of providers that are considered rookies, i.e. new hires not assimilated yet to the military culture, current IT systems, processes, etc.

(162) Step Height = $\text{INITIAL}((\text{BH Referral Rate} + \text{SMUN SRate} + \text{Remission Rate} - \text{Attrition Rate}) / \text{Military Population})$

Units: **undefined**

Height of step input to customer orders, as fraction of initial value.

Used by:

(058) Enlistment Fraction

(079) Input - Input is a dimensionless variable which provides a variety of test input patterns, including a step, pulse, sine wave, and random noise.

(163) Step Time = 0

Units: Week

Time for the step input.

Used by:

(079) Input - Input is a dimensionless variable which provides a variety of test input patterns, including a step, pulse, sine wave, and random noise.

(164) Suicide Fraction[SMUN] = 0.05 / 52

Suicide Fraction[SMIN] = 0.05 / 52

Suicide Fraction[SMIDC] = 0.02 / 52

Suicide Fraction[SMONC] = 0.02 / 52

Suicide Fraction[HP] = 0.01 / 52

Units: Dimensionless

Suicide fraction is different depending on the health status of the service member. The fraction highest among service members that have mental health condition are not being treated.

Used by:

(155) SMs in Direct BH Care - Total number of service members in direct care at any time is based on integration of inflows and outflows from this stock.

(158) SMs w/ Unidentified BH Needs - Based on the inflow of service members afflicted with behavioral health conditions, as well as those that drop out of care prematurely.

(160) Std Intake Workweek Fraction

(153) SMIDC SRate

(154) SMIN SRate

(159) SMUN SRate

(165) Suicide Rate = SMIDC SRate + SMIN SRate + SMUN SRate

Units: People/Week

Total Suicide Rates accross the whole population

Used by:

(103) Number Of Suicides - Total Number of Suicides accross the simuation period.

(166) Surge Amount = 200

Units: Patients/Week

Used by:

(126) Referral Surge

(167) Surge Duration = 12

Units: weeks

Used by:

(126) Referral Surge

(168) Surge Start Time = 24

Units: weeks

Used by:

(126) Referral Surge

(169) Table For Effect Of Burnout on Turnover ([(0,0)-(3,5)],(0,1),(1,1),(2,5),(3,5))

Units: **undefined**

Used by:

(042) Effect of Burnout On Turnover - The effect of burnout is driven proportional to long term workweek relative to total standard workweek.

(170) Table of Effect of Fatigue on Productivity ([(0,0)-(160,1.3)],(0,1.1),(20,1.07),(40,1),(60,0.8),(80,0.4),(100,0.1),(120,0.03),(140,0.01),(160,0))

Units: Dimensionless

The higher the workweek the lower the productivity

Used by:

(046) Effect of Fatigue on Productivity

(171) Table of Effect of Fatigue on PR ([(0,0)-(3,1)],(0,1),(1,1),(1.2,0.98),(1.4,0.96),(1.6,0.93),(1.8,0.89),(2,0.84),(2.2,0.78),(2.4,0.7),(2.6,0.6),(2.8,0.43),(3,0))

Units: Dimensionless

Used by:

(045) Effect of Fatigue

(172) Table of Effect of Inexperience on PR ([(0,0)-(1,1)],(0,0),(0.1,0.45),(0.2,0.7),(0.3,0.84),(0.4,0.9),(0.5,0.95),(0.6,0.98),(0.7,1),(1,1))

Units: Dimensionless

Used by:

(047) Effect of Inexperience

(173) Table of Effect of Treatment Gap on PR ([(0,0)-(4,1)],(0,1),(0.5,1),(1,1),(1.25,0.98),(1.45,0.94),(1.6,0.85),(1.8,0.7),(2,0.6),(2.5,0.5),(3,0.4),(3.5,0.38),(4,0.35),(4.5,0.35))

Units: **undefined**

Used by:

(051) Effect of Time between Appointments

(174) Target Treatment Time = 7

Units: weeks

Optimal time for the full course of treatment

Used by:

(036) Desired Treatment Rate - Desired Recovery rate is based on the target treatment time (based on clinical practice guidelines on the frequency and time between therapy appointments), probability of recovery and the number of service members in direct care treatment.

(193) Treatment Encounters - Calculated either based on realized treatment rate or idealized treatment rates.

(175) Time Between Appointments = $\text{Max} (1, \text{SMs in Direct BH Care} * \text{Encounter Duration} / (\text{Service Capacity} * \text{Care Workweek Hours Per Provider}))$

Units: weeks

Time between appointments is defined as the number of days between each therapy encounter. The minimum time between appointments is 1 week. However the waiting time between appointment can grow based on the capacity constraints. In this case capacity constraints are defined by the ratio between the number of SMs in direct BH care and capacity (number of patients that can be served in any given week)

Used by:

(051) Effect of Time between Appointments

(195) Treatment Time - Treatment time corresponds to the total amount of time it takes for an SM to get a full course of treatment, ie. number of therapy sessions times the time between each session. It is therefore found by multiplying the number of sessions and the time between sessions.

(176) TIME STEP = 0.125

Units: Week [0,?]

The time step for the simulation.

Used by:

(140) SAVEPER - The frequency with which output is stored.

(201) White Noise - White noise input to the pink noise process.

(177) Time To Adjust Affordable Workforce = 52

Units: weeks

A typical time it takes to get an approval for an adjusted budget. Budgets are usually done yearly. With more ad hoc request that are processes throughout the year

Used by:

(005) Affordable Workforce - Number of providers that is possible based on the budget.

(178) Time To Adjust Desired Workforce = 12

Units: weeks

Based BH Clinic's chief's ability to notice and adjust requirements for desired workforce based on changes in demand. NEED TO BE VERIFIED!

Used by:

(038) Desired WorkForce - Based on needed number of providers to meet access to care and evidence based practice standards, adjusted by the management's perception of provider effectiveness/productivity.

(179) Time To Adjust InTake Fraction = 1

Units: weeks

Time to decrease intake fraction based on the need. It only takes a week to realize that it should be decreased given that the demand for intakes decreased.

(180) Time To Adjust Workforce = 4

Units: weeks

Based on yearly budget updates. NEED TO BE VERIFIED

Used by:

(199) Vacancy Adjustment Rate

(202) Workforce Adjustment Rate - Based on the difference between total number of providers and the number of providers authorized based on capacity requirements and budget constraints.

(181) Time To Cancel Vacancies = 1

Units: Week

Time it takes to cancel an open position.

Used by:

(073) Hire Approval Rate - Based on desired hiring rate plus any adjustment to the vacancies based on current listing as compared to what is desired. The MAX function ensures that more vacancies than are currently in the stock cannot be canceled.

(182) Time To Find And Credential A Hire = 26

Units: weeks

An average time it takes to find a qualified hire for a provider vacancy position that actually accepts the offer. This time also includes the time it takes to credential the new provider required before he is able to treat patients.

Used by:

(037) Desired Vacancies

(074) Hiring Rate - The hiring rate is based on the number of vacancies(open positions) and the average time it takes to hire a provider to fill a position.

(183) Time To Perceive Productivity = 52

Units: weeks

Update of provider productivity is based on yearly budget updates.

Used by:

(110) Perceived Provider Effectiveness - A delayed perception of provider effectiveness based on past productivity.

(184) Time To React to Quality of Care = 12

Units: weeks

Used by:

(006) Attractiveness of Care - Attractiveness of Care is determined by several key factors (access and recovery waiting time and apathy of providers). This variable is modulated by the sensitivity variable.

(185) Total Lost NPV = NPV Lost To TriCare and Attrition + Desired NPV - Current NPV

Units: \$

(186) Total Providers = Credentialed Providers + Rookie Providers

Units: Providers

Total number of providers

Used by:

(010) Average Effectiveness

(012) Base Budget - Base Budget

(109) Patient Load - Patient load of each provider

(110) Perceived Provider Effectiveness - A delayed perception of provider effectiveness based on past productivity.

(130) Rookie Fraction - The fraction of rookie providers

(139) RVUs Per Provider

(202) Workforce Adjustment Rate - Based on the difference between total number of providers and the number of providers authorized based on capacity requirements and budget constraints.

(187) Total Quit Rate = Providers Quit Rate + Rookie Quit Rate

Units: Patients/Week

Defined as the rate of total providers quitting the service.

Used by:

(129) Replacement Rate - Equivalent to the total quit rate

(188) Total RVUs = Max Encounters Per Week * RVUs Per Encounter

Units: RVUs/Week

Total RVUs generated based on the number of patients served and RVUs generated per patient per episode.

Used by:

(012) Base Budget - Base Budget

(017) Budget - Total Budget is based on the base budget plus the RVU based calculation for the total population served.

(139) RVUs Per Provider

(189) Total Std Workweek = 40

Units: Hours/Week

Used by:

(155) SMs in Direct BH Care - Total number of service members in direct care at any time is based on integration of inflows and outflows from this stock.

(157) SMs w/ Identified BH Needs - Accumulation of service members with identified behavioral health needs.

(158) SMs w/ Unidentified BH Needs - Based on the inflow of service members afflicted with behavioral health conditions, as well as those that drop out of care prematurely.

(030) Desired Care Capacity - Defined by the desired number of patients that receive full course of treatment per week, therapy duration and the number of workweek hours providers dedicate to care treatments.

(034) Desired Intake Capacity - Is based on desired in-take rate (that meets access to care standards), the time it takes to complete a standard in-take appointment and the standard number of weekly hours required by each provider to dedicated for in-take appointments.

(042) Effect of Burnout On Turnover - The effect of burnout is driven proportional to long term workweek relative to total standard workweek.

(045) Effect of Fatigue

(086) Long Term Workweek - Exponential smoothing of the total workweek over the period of burnout onset.

(122) Recent Workweek - Smoothed over workweek based on the differential between standard workweek and actual

(190) Total Workweek - Total Workweek is a standard workweek with additional hours as a consequence of an effect of work pressure.

(190) Total Workweek = Total Std Workweek * Effect Of Work Pressure on Workweek

Units: Hours/Week

Total Workweek is a standard workweek with additional hours as a consequence of an effect of work pressure.

Used by:

(021) Care Workweek Hours Per Provider - Based on the total number of hours providers work and the fraction of the week dedicated to intake appointments.

(084) InTake Workweek Hours Per Provider - Total hours in a given week provider allocates for in-take appointments only

(086) Long Term Workweek - Exponential smoothing of the total workweek over the period of burnout onset.

(122) Recent Workweek - Smoothed over workweek based on the differential between standard workweek and actual

(191) Total Yearly Encounters = INTEG(Encounters Per Week - Yearly Encounters , Encounters Per Week * Delay)

Units: Encounters

Used by:

(205) Yearly Encounters

(192) Training Time = 6

Units: weeks

The average time it takes to credential and train the provider.

Used by:

(019) C/T Rate - The rate at which providers get credentialed and trained.

(161) Steady State Rookie Fraction - A steady state rookie fraction is used for initialization.

(193) Treatment Encounters = IF THEN ELSE (Realized Care Demand Switch = 1, SMs in Direct BH Care / (Treatment Time / Number Of Encounters) , SMs in Direct BH Care / (Target Treatment Time / Number Of Encounters))

Units: Patients/Week

Calculated either based on realized treatment rate or idealized treatment rates.

Used by:

(090) Max Encounters Per Week - Calculated by adding up the number of in-take appointments and number of regular encounters per week.

(194) Treatment Rate = SMs in Direct BH Care / Treatment Time

Units: Patients/Week

(195) Treatment Time = Time Between Appointments * Number Of Encounters

Units: weeks

Treatment time corresponds to the total amount of time it takes for an SM to get a full course of treatment, i.e. number of therapy sessions times the time between each session. It is therefore found by multiplying the number of sessions and the time between sessions.

Used by:

(052) Effect of Treatment Waiting Time

(124) Recovery Rate - Recovery Rate represent the number of patients that recover from behavioral health condition as deemed by the providers. It is based on the number of patients in direct care treatment, the time it takes for a person to get necessary treatment and the probability of recovery based given the service member received the needed treatment.

(193) Treatment Encounters - Calculated either based on realized treatment rate or idealized treatment rates.

(194) Treatment Rate

(196) Urgent Cases Fraction = 0

Units: Dimensionless

A fraction of service members that require urgent care (i.e. appointment within 24 hours)

Used by:

(033) Desired In Take Rate - Desired In-Take Rate is based on the target wait time of patients for their in-take appointments. The target wait times are based on Access To Care standards for routine mental care appointments. The target wait time for urgent care is 1/7 of that of a standard routing mental care, i.e. 1 day.

(091) Maximum InTake Rate - Determined by all those seeking appointment able to get them within 24 hours.

(197) Urgent Target Wait Time = 1 / 7

Units: weeks

Urgent cases are required to be seen in a 24 hour window

Used by:

(033) Desired In Take Rate - Desired In-Take Rate is based on the target wait time of patients for their in-take appointments. The target wait times are based on Access To Care standards for routine mental care appointments. The target wait time for urgent care is 1/7 of that of a standard routing mental care, i.e. 1 day.

(198) Vacancies = INTEG(Hire Approval Rate - Hiring Rate , Desired Vacancies)

Units: Providers

The number of Vacancies for providers at any given time is based on the net of hire approval rate and hiring rate of providers.

Used by:

(073) Hire Approval Rate - Based on desired hiring rate plus any adjustment to the vacancies based on current listing as compared to what is desired. The MAX function ensures that more vacancies than are currently in the stock cannot be canceled.

(074) Hiring Rate - The hiring rate is based on the number of vacancies(open positions) and the average time it takes to hire a provider to fill a position.

(199) Vacancy Adjustment Rate

(199) Vacancy Adjustment Rate = (Desired Vacancies - Vacancies) / Time To Adjust Workforce

Units: Providers/Week

Used by:

(073) Hire Approval Rate - Based on desired hiring rate plus any adjustment to the vacancies based on current listing as compared to what is desired. The MAX function ensures that more vacancies than are currently in the stock cannot be canceled.

(200) Wait Time Limit = 4

Units: weeks

Used by:

(106) ON Intake Rate

(201) White Noise = Noise Standard Deviation * ((24 * Noise Correlation Time / TIME STEP) ^ 0.5 * (RANDOM 0 1 () - 0.5))

Units: Dimensionless

White noise input to the pink noise process.

Used by:

(023) Change in Pink Noise - Change in the pink noise value; Pink noise is a first order exponential smoothing delay of the white noise input.

(202) Workforce Adjustment Rate = IF THEN ELSE (Authorized Workforce = Total Providers , 0 , (Authorized Workforce - Total Providers) / Time To Adjust Workforce)

Units: Providers/Week

Based on the difference between total number of providers and the number of providers authorized based on capacity requirements and budget constraints.

Used by:

(032) Desired Hiring Rate

(203) Workweek Switch = 1

Units: **undefined**

Used by:

(053) Effect Of Work Pressure on Workweek

(204) Yearly Base Discount Rate = 0.3

Units: Dimensionless

Base yearly discount rate

Used by:

(001) 10 Week Discount Factor - The sum of discount factors for a 10 week period.

(039) Discount Factor

(205) Yearly Encounters = Total Yearly Encounters / Delay

Units: Encounters/Week

Used by:

(191) Total Yearly Encounters

(206) Yearly Suicides = Number Of Suicides / Delay

Units: People/Week

Used by:

(103) Number Of Suicides - Total Number of Suicides across the simulation period.

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