Confronting the One-armed Bandit: Patient Satisfaction Following Department of
Veterans Affairs Wait-time Crisis Policy Changes

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Paper prepared for presentation at the 40th annual research conference of the Association for
Public Policy Analysis and Management (APPAM), Washington, D.C., November 8-10, 2018.
Abstract:

Given the recent Department of Veterans Affairs (VA) wait-time crisis, exposed by CNN in a series of 2013 and 2014 articles and confirmed by the June 2014 VA office of the Inspector General report, inferences drawn from examining VA performance data are important to the analysis of VA health care policy reforms. This study attempts to identify VA hospital-level determinants of patient satisfaction following reformative policy decisions in the wake of the wait-time reporting crisis, utilizing Keller and Rady’s (1999) monopolist extension of Rothschild’s (1974) one-armed bandit problem in economics. Analyses are conducted using quarterly 2013 to 2018 performance data collected from a nationwide set of 145 VA hospitals in all 50 states. This study, when considering hospital-level VA primary care wait-time data and other performance measures, facility resources, and local area demographic characteristics, hypothesizes that 1) patient satisfaction scores are positively influenced by increased ORYX performance scores and 30-day wait-time statistics once VA policy reforms were implemented to address misreported wait-time practices, 2) patient satisfaction scores trend higher at VHA medical centers with fewer inpatient beds, and 3) though patient satisfaction scores increase as employees are more likely to be satisfied with their workplace and recommend it to others, employee satisfaction with their job and organization decreases as patient satisfaction increases.
Introduction

According to the Congressional Research Office (Bagalman 2014), the question of how many veterans utilize services at the Veterans Health Administration (VHA) is a simple one. Yet, for veterans wishing to utilize VHA services, access to these services in recent years has been stymied by shortages in primary care physicians, unexpected surges in aging Vietnam veterans and severely wounded post-9/11 veterans, and administrative coverups (USA Today 2014). The year 2015 saw a 50% increase in the number of veterans on waiting lists for healthcare, sparking a Department of Veterans Affairs (VA) response that generated 2.7 million more appointments, 900,000 additional appointments approved for outside treatment, and in increased capacity of over 7 million patients (Oppel Jr. 2015, p. 1). Despite the alarming trend in barriers to healthcare access, Bagalman (2014) reports that, since 2001, the total U.S. veteran population has been in decline, while the number of veterans enrolled in VA healthcare has increased. Specifically, 19.6% of all veterans were enrolled in VA healthcare in 2001, yet in 2014 that number rose to 42.1% (Bagalman 2014, p. 3). The Department of Veteran Affairs projects that veteran enrollment rates will reach 50% by 2019, and increase incrementally through 2024 (RAND Corporation 2015, p. B-10).

Though many veterans may opt out of VA healthcare benefits for the private market (Kashner et al. 1998), or choose dual private and VA healthcare (Borowsky & Cowper 1999; Wolinsky et al. 2006), the mission of the VA “[t]o care for him who shall have borne the battle” (U.S. Department of Veteran Affairs n.d.a, p. 2) echoes the VA’s obligation to provide access to healthcare benefits earned through military service. The recent VA wait time crisis, a market failure marred by a witch’s brew of internal VA shortcomings, may contribute in-part to veteran barriers to care. Therefore, a greater understanding of the influence of VHA performance
measures on patient satisfaction may enhance existing knowledge of the VA’s responsiveness to the exposed wait time crisis.

The VHA’s Strategic Analytics for Improvement and Learning Model (SAIL) is “a system for summarizing hospital system performance within Veterans Health Administration,” which “assesses 25 quality measures in areas such as death rate, complications, and patient satisfaction, as well as overall efficiency and physician capacity at individual VA Medical Centers (VAMC’s)” (U.S. Department of Veterans Affairs n.d.b). The VHA SAIL reports are published quarterly and made available to the public through the VA’s online database (www.data.va.gov). The reports include an individual hospital’s performance scores, VHA facility resource scores, and VHA employment satisfaction scores. These scores are calculated according to a variety of metrics, many of which are composite scores from multiple measurements. The SAIL reports also offer a summary of the measure units for each line-item’s score. Though these quarterly SAIL reports are amended periodically, they remained consistent in form within each quarterly publication.

Utilizing the VHA’s quarterly Strategic Analytics for Improvement and Learning reports from 2013 to 2018, this study develops three research questions regarding VHA wait-time crisis reform efforts. 1) What VHA performance measures significantly impact patient satisfaction? 2) What significant impact, if any, does the availability of VHA facility resources have on patient satisfaction? 3) What VHA employment satisfaction measures significantly impact patient satisfaction? This study derives three hypotheses from these three research questions. H1) Patient satisfaction will be positively influenced by increased performance measures such as wait-times, call center responsiveness, and ORYX measures (which will be discussed below in greater detail). H2) Patient satisfaction will be positively influenced by the increased availability of
VHA facility resources. H3) Patient satisfaction will be positively influenced by increased VHA employment satisfaction scores. Following the analyses, this study’s findings, potential implications, and conclusions are presented.

**Background: The Federal Government’s Response to the VA Wait-time Crisis**

**Executive Action**

The VA wait time crisis, exposed by CNN in a series of articles from 2013 to 2014 (Bronstein et al. 2013; Bronstein et al. 2014; Bronstein & Griffin 2014), revealed a growing trend of falsified VHA appointment records and reports designed to track medical care wait times for veterans. This wait time crisis was confirmed by the June 2014 VA office of the Inspector General report, revealing a failure by the VA’s 150 hospitals and 820 outpatient clinics to treat over 200,000 veterans seeking first-time primary care appointments within 14 days (Hoyer & Zoroya 2014). For whatever reason, the VA set this 14-day limit for wait times despite being five days less than the average for the private sector (*USA Today* 2014). Then-Secretary of the VA Eric Shinseki, citing the tough 14-day wait time standard as a potential catalyst for record falsifications, revoked a standing order that linked the 14-day standard to VHA employee bonuses and salary increases (Hoyer & Zoroya 2014). Shinseki resigned his position as VA secretary on May 30, 2014 (Jaffe and O’Keefe 2014).

Following Shinseki’s resignation, then-President Obama appointed Robert McDonald as the new VA Secretary, who was eventually confirmed by the Senate (Kennedy 2014). During his tenure, McDonald drew wide-ranging support from some of the nation’s top veteran groups (e.g. the American Legion, Amvets, and Disabled American Veterans) due to the incremental reforms the then-Secretary was able to implement (Phillipps 2016). Among McDonald reforms is the “MyVA” initiative (Wentling 2017), a plan designed to methodically reform the VA experience
through five transformative strategies: improving the veteran experience, improving the employee experience, achieving support services excellence, establishing a culture of continuous performance improvement, and enhancing strategic partnerships (U.S. Department of Veterans Affairs 2016).

Following McDonald’s departure, President Trump nominated Dr. David Shulkin to replace McDonald, who was confirmed unanimously by the Senate (Carney 2017). Shortly after taking over, Shulkin announced an ambitious 12-point reform package targeting nearly every aspect of the VA, which include promises to: improve the timeliness of veterans’ access to care, reduce the backlog of disability claims, expand community care options, and improve VA information technologies (Shane 2017). Shulkin’s tenure, despite his ambitious reform efforts, became marred with controversy (Wentling 2018). Shulkin was eventually replaced by Robert Wilkie, the current Secretary of Veterans Affairs.

**Legislation**

At the outset of the VA wait time crisis, the Phoenix, Arizona VA Health Care system found itself at the epicenter of this seismic scandal, which reportedly saw the deaths of 40 veterans while they waited on a secret waiting list, hidden from public view. In response, Congress passed the Choice Act, a new law intended to “improve the access of veterans to medical services from the VA, and for other purposes” (Veterans Access, Choice and Accountability Act 2014, p.1754). According to a U.S. Department of Veterans Affairs (n.d.a) Fact Sheet, the Choice Act “provides new authorities, funding and other tools to help support and reform (the) VA. Included in these reforms is Project Access Received Closer to Home (ARCH). This pilot program is designed to improve access for eligible veterans by connecting them to health care services closer to home and is based on criteria such as driving distance from home and acute hospital care (U.S.
Department of Veterans Affairs n.d.c). As well, the Act directs the VA to improve patient access to “telemedicine and other health care services through standardization and greater use of mobile vet venters and mobile medical centers” (U.S. Department of Veterans Affairs n.d.c, p. 2). The Choice Act mandates that each VA medical facility post online primary and specialty care wait-times, along with data regarding VHA patient safety, quality of care, and outcome measures; additionally, the Choice Act instructs the VA to enter into one or more contracts with independent third parties for assessments of VHA hospital care (U.S. Department of Veterans Affairs n.d.c). Finally, the Choice Act included a provision for the expedited removal of VA executives found guilty of misconduct or gross negligence (Wagner 2017), which was utilized to remove Sharon Helman, the head of the Phoenix, Arizona VA Health Care system.

**Federal Courts**

Helman challenged her termination in court, claiming that the 2014 Act violated the Constitution’s “appointment clause” by giving too much power to executive branch Administrative Law Judges (Wagner 2017). The U.S. Federal Appeals Court upheld Helman’s claim, permitting her to appeal to the U.S. Merit Systems Protection Board. The Federal Court’s 2017 ruling on Helman grants the fired Arizona VA executive Sharon Helman an appeal of her termination based on the three-part procedural due process test (Lobsenz 1984, 381). The showdown between the judicial, legislative, and executive branches lies with Helman’s argument that provisions of the Choice Act, authorizing an ALJ to rule on her termination, violated Constitutional protections outlined in the “appointment clause.” The VA argued that “department heads are able to delegate their authority to appoint inferior officers,” thereby retaining the (non-significant) authority to terminate executives via ALJ decisions (*Helman v. DVA* 2017, 9-10). An analysis of current interpretations and policies applying Article II, Section 2 of the Constitution
to the removal authority of VA executives will provide policy alternatives to remedy this 3-way power struggle. The Appellate Court’s ruling, a direct challenge to executive and legislative branch power, highlights a new, contentious policy issue amidst efforts to reform the VA health care system.

**Literature Review**

As mandated by the Choice Act, the VHA has developed a VHA hospital assessment program that continues to be monitored and updated. Though the VA has responded, a single source of assessment (even if from an independent third party) may be limited in its ability to provide the public with a complete program evaluation. This study aims to further illuminate the influence of VHA wait-time crisis reform efforts. How the VA sets about its reform efforts may be explained via bandit problems of economics.

**Theory**

In economics, bandit problems refer to a sequential decision problem where a decision-maker, knowing the “state” of each action, must choose one of $n$ available actions for each iteration (Jun 2004, p. 513). When an action is chosen the decision-maker, some information about that action is revealed and he or she receives a corresponding payoff, yet the states of actions may change over time (Jun 2004). The received information may aid in informing future choices of action, as the decision-maker’s goal is to maximize the series of payoffs received by choosing the correct sequence of actions (Jun 2004). The concept of the bandit is described metaphorically by Rothschild (1974) as a slot machine. Rothschild’s one-armed bandit thus represents a (mechanical) slot machine with a single lever that must be pulled to play. Here the dilemma for the decision-maker is the availability of only one machine to play, even if the states of actions for the one machine may change. In the case of a multi-armed bandit, a decision-
maker much decide which lever among multiple different slot machines to pull, each independent of each other with changing payoffs (Bergemann 2006). Bergemann (2006, p.1) describes this scenario’s trade-off between exploration (trying out each arm to find the best one) and exploitation (playing the arm believed to yield the best payoff).

When applied to economics, the decision-maker facing one or more bandits is a (business) firm who supplies goods or services on the market. The firm is assumed to prefer the maximization of its profits according to a choice of how to price its product; however, the dilemma faced by the firm lies in knowing the demand function of its consumers for the offered product. Rothschild (1974) explains that the more comprehensive understand a firm has of its demand function, the more accurately it can predict consumer demand, thus reducing the uncertainty it faces and allowing for a more utilitarian price selection. Since perfect information is not as likely according to Rothschild, a firm operating with an imperfect understanding of its demand function faces uncertainty, and therefore faces the bandit problem when deciding how to price its product.

Keller and Rady (1999) examine bandit problems faced by a decision-maker (or agent) who is a monopolist facing an unknown and changing demand function, yet still wishes to maximize expected profits over an unspecified period of time. Keller and Rady (1999) posit two possible states for the monopolist’s dilemma, in which the monopolist has some information regarding its demand function. Still, as is the case for a bandit problem, the monopolist must make a choice. Keller and Rady (1999, p. 475) explain the importance of information in the monopolist’s pursuit of maximized utility, stating that the agent who exhibits large deviations from myopic behavior will be able to track the state well, while the agent who exhibits small deviations from myopic behavior will track the state poorly at the risk of becoming “trapped” into a set of actions that
prevents the agent from understanding the true demand function. Finally, Keller and Rady (1999) elect to use a continuous-time model, which they believe offers the ability to identify the optimal policy choice. Several studies of bandit problems note the applicability of Bayesian analysis (Bergemann 2006; Goldenshluger and Zeevi 2009; Jun 2004; Rosenberg, Sloan, and Vieille 2007), including studies using the continuous time model (Bolton and Harris 1999; Keller and Rady 1999). This continuous-time model appears well-suited to a government agency or department with no projected program termination.

**Policy Reform**

For a monopolist facing a bandit problem, uncertainty is inherent to the dilemma. An outcome from one sequence of choices may be better or worse than a different sequence of choices. For the decision-maker whose goal is to maximize his or her utility, the possibility of an undesirable outcome exists. In the case of an undesirable outcome, it may be expected that a decision-maker would regret the sequence of choices made under uncertainty.

As Aizenman and Yi (1997, p. 270) explain, regret theory is an extension of the standard expected-utility theory in which the decision-maker experiences a regret when the outcome of a choice under uncertainty is worse than the status quo and experiences a rejoice when the outcome of such a choice better than the status quo. Aizenman and Yi focus their study on an individual decision-maker in times of crisis, noting the important role of the status quo (or the choiceless state) explained by Loomes and Sugden (1982). Aizenman and Yi (1997, p. 271) argue that regret theory offers an explanation for reforms undertaken in times of an economic crisis, which they define as an event that reduces the status-quo income and thus increases the utility cost of undertaking the reform, but by a lesser amount than the status-quo income. Aizenman and Yi (1997, p. 271) further explain that before the crisis occurs, the potential reform
is assumed to be “equally attractive for a regret-experiencing decision maker than for an expected-utility maximizer.”

Beyond regret, Robinson (1998, p. 2) posits the occurrence of “inappropriate or ‘bad’ government policies.” Robinson seeks to explore why bad policies are ever adopted. Robinson (1998, pp. 9-10) categorizes governments into three types according to their nature: the deferential Pliant State, the independent Autonomous State, and the even more autonomous Predatory State. Robinson’s Pliant State appears to be more responsive to pluralism and the will of voters, while the more independent categories display characteristics of elitism and a perception that the government has interests of its own to consider. Robinson (1998, p. 11) notes that bad decisions may be made within all three categories, but laments that the models he provides “neglect the structure of government as an institution, and provide only the most stylized representation of the links between state and society.” Robinson believes both may be key factors in determining if a given government policy is bad. Finally, Robinson likens good policy to that which is Pareto efficient and bad policy to that which is Pareto inefficient.

Despite the potential for inefficient or even bad policy, Pierson (2000) posits the tendency for government institutions to be resistant to change (for the sake of policy continuity) due to path dependency. While it may be argued that policy actors protect the status quo, even in a less than optimal state (Cerna 2013), Greener (2002) posits that policymakers often face pressures and constraints from the public, whether those pressures and constraints be for or against reform. When applied to a government agency or department, there may be times when the public is unsupportive of certain reformatory policies designed to improve outcomes for a specific target population. However, this could seemingly work both ways, leaving the monopolistic decision-maker to face a bandit problem.
VHA Patient Access and Staffing

Given the VA’s mission, and over 20 million veterans in the U.S. (Bialick 2017), the VA is the one of largest department within the federal government, employing 337,683 employees as of 2013 (U.S. Office of Personnel Management n.d.). The VA’s 2018 budget was set by the House of Representatives at $182.3 billion (Panangala 2018, p.8). Not only does this keep the VA’s performance and efficiency in the crosshairs of taxpayers, but it also suggests that many veterans will remain attentive to the quality of VA services they receive. Given the recent wait-time crisis, the VA has been scrutinized for its patient access and staffing deficiencies.

Aside from delayed access due to the wait-time crisis, many veterans already face additional barriers to accessing VA health care. For veterans with VA and Medicare health care policies (who would seemingly be better off than veterans with only one available health care option), research has suggested their access to health care has improved; however, concerns remain that dual use may often result in discontinuity and duplication of care, generating wasted health care resources (Hynes et al. 2007). As well, vulnerable, high-risk classes of veterans often experience barriers to VA health care via socioeconomic status and competing demands (among veterans seeking care), including homeless veterans, veterans with serious mental illnesses, and elderly veterans (O’Toole et al. 2011). Research has identified access barriers that are specific to female veterans, including knowledge gaps in VA eligibility and the availability of services for women (Brooks, et. al 2013; Washington et al. 2011). Finally, Elnitsky et al. (2013) illuminate access barriers to veterans with polytraumatic injuries, who typically experience physical, psychological, and psychosocial impairments that require a multitude of VHA services.

Staffing at VHA medical centers have been the subject of studies prior to and after the VA wait-time crisis. One study finds that nurses working in the VHA system have a generally more
positive attitude towards their work environment than U.S. nurses not in the VHA and nurses working in other countries (Sales, Sharp, Li, Greiner, Lowry, Mitchell, Sochalski, and Cournoyer 2005). Hoyer (2015) paints a much different picture ten years later, explaining that the Freedom of Information Act reveals staffing shortages not previously seen prior to the Act’s passage. Hoyer (2015) notes that even a one percent increase in VHA job vacancies can increase number of veterans experiencing wait-times of over one month. Hoyer cites complex hiring procedures, poor recruitment processes, and Oppel (2015) adds budgetary constraints to the list of likely staffing shortage determinants. The outlook in 2005 seems quite different from the 2015 outlook, and though budget constraints may be an easy place to lay blame, an explanation of recent staffing shortages may be far more complex. An even more recent study posits the generally high burnout rate within the primary care industry; as well, the authors utilize national surveys of VHA primary care employees to demonstrate that burnout among this group has increased significantly in recent years (Helfrich, Simonetti, Clinton, Wood, Taylor, Schectman, Stark, Rubenstein, Fihn, and Nelson 2017). Despite some disparity in studies regarding VHA primary care employee esprit de corps, staffing conditions have been attributed (at least in part) to increased wait-times for veterans.

**VA Wait-times**

Among hundreds of surveyed veterans enrolled in VA healthcare services, many praised the care they receive, yet a substantial proportion of these veterans expressed frustration with delayed access to needed care (Goodnough, 2014). Extended wait-times for care have been found to have a significant effect on healthcare outcomes, with staffing shortages receiving at least partial blame for these delays (Hoyer, 2015; “What ails the VA doesn't lend itself to quick cures,” 2014; Winslow 2017). Pizer and Prentice (2011), addressing wait time related concerns
of utilization and health outcomes, find: 1) small yet significant decreases in utilization, and 2) a clear indication of poorer health, especially among older and at-risk veterans. In the worst-case scenario of patient mortality, Prentice and Pizer (2007, p. 652) find that veteran patients held a significantly higher mortality rate when VA healthcare wait-times exceeded 31 days.

**Program Evaluation**

Following the exposure of the VA wait-time crisis, pressure mounted for an investigation and evaluation of VA health care policies. The seminal work of Cronbach et al. (1980), who call for a revolution of program evaluation reform, has inspired several reviews. Gowin and Millman (1981, p. 85) offer a simple explanation of program evaluation’s genealogy, that “any good society with democratic principles of governance will evaluate its social experiments, seeking to improve conditions of life and to make its evaluation procedures better.” However, at the time Cronbach et al. express dissatisfaction with the state of program evaluation. The authors believed that program evaluation practices often lacked systematic and purposeful attributes, which may result in 1) the collection of facts to no relevant end, 2) the collection of facts without sufficient organization and interpretation for use, and 3) “would-be evaluations that are strong in judgement but have no systematic investigation behind it” (Cronbach et al. 1980, p.16). Instead, Cronbach et al. (1980, p. 61) recommend that evaluative inquiry include the following four attributes: the ability to influence social thought, that it be set up by the responsible agency, evidence should be collected on experience from existing programs and methods used by the evaluator should be made transparent, and a fair-minded evaluator should provide a comprehensive and disciplined evaluation in which collected data is made available for independent scrutiny and interpretation.
Cronbach et al. enumerate a list of “sins” of evaluation, and Rossi (1981) summarizes this list into four main categories: hubris, pride, ignorance, and orthodoxy. Rossi (1981, p. 61) explains hubris as “manifested in the evaluators’ expectations that their findings will rule in the decisions made by policymakers.” Pride is “manifested in evaluators’ unwillingness to communicate with those individuals and groups who have a right to know what evaluators find out” (Rossi 1981, p. 61). Ignorance is “manifested in a variety of forms,” and Rossi (1981, p. 62) states that “among the worst forms is neglecting to keep in mind constantly that evaluation is a pan-social science activity” which calls for diverse knowledge. Finally, Rossi (1981, p. 62) considers orthodoxy to be “adherence to the forms of research methods without regard to the information needs or relevant audiences or the particular stage of program development.” Lastly, though critical of Cronbach et al., Worthen and Cronbach (1982, p. 494) posits the inherent risks to objective and honest program evaluation when employment, control of salary, and additional prerequisite means of influence permeate the corps of “in house” evaluators or evaluation contractors.

**VHA Program Evaluation**

As one of the largest departments in the federal government, the VA is mandated (via the Veterans Access, Choice and Accountability Act 2014) to ensure its own programs are evaluated; however, it also is subject to external program evaluation. For its internal evaluations, the Department of Veterans Affairs Office of Inspector General aims to “serve veterans and the public by conducting effective oversight of the programs and operations of the [VA] through independent audits, inspection, reviews, and investigations” (U.S. Department of Veterans Affairs n.d.d). Information regarding the VA Inspector General Office’s published reports can be found on its website ([www.va.gov/oig/](http://www.va.gov/oig/)). One such report is the Comprehensive Healthcare
Inspection Program (CHIP) that “provides a focused evaluation of the quality of care delivered in the inpatient and outpatient settings” of an individual VA medical center (U.S. Department of Veterans Affairs 2017). The CHIP review covers clinical and administrative processes associated with the promotion of quality care (U.S. Department of Veterans Affairs 2017). A CHIP review is conducted on a (roughly) 3-year basis for each facility and specifically focuses on: 1) leadership and organizational risks, 2) quality, safety, and value, 3) coordination of care, 4) environment of care, 5) high-risk processes, and 6) long-term care (U.S. Department of Veterans Affairs 2017).

External sources of VHA program evaluation come from a variety of sources. First, newspapers and the media may conduct investigative reports, exemplified by USA Today and CNN’s reporting on the VA wait-time crisis. Next, government documents from congressional committee hearings are made available to the public (e.g. U.S. Congress 2003). Finally, academic journal articles have conducted their own independent VHA program evaluations such as VHA collaboration with clinical partners (Wu et al. 2014), the Virtual Lifetime Electronic Record health program’s health information exchange (French et al. 2016), mental health programs (Kearney et al. 2018) that include the use of VA SAIL data (Lemke, Boden, Kearney, Krahn, Neuman, Schmidt, and Trafton 2017), and have suggested reformative policy alternatives for the VHA (Bakaeen, Blaustein, and Kibbe 2014; Jha 2016).

An examination of VHA policy problems, reform efforts, and program evaluations reveals varied reporting on the efficient and effective implementation of VHA programs. Though some external program evaluations have been conducted, much of the current VHA program evaluation domain consists of evaluations conducted either by internal VHA sources or by third-party sources contracted by the VHA. Given the paucity of academically-conducted VHA medical center program evaluations, this study may provide some contribution to informing 1)
policymakers interested in new ways to formulate reformative VHA policies and 2) veterans who wish to utilize VHA medical centers. By applying Keller and Rady’s monopolist extension of Rothschild’s one-armed bandit problem, this study hypothesizes that: 1) patient satisfaction scores will tend to be positively influenced by increased performance measure scores, including primary care wait-times, 2) patient satisfaction scores will tend to increase as facility resources improve to meet the relative demand from the local area veteran population, and 3) patient satisfaction scores will tend to increase as VHA employment satisfaction scores increase.

Data and Variables

Data

For this analysis, data from the VHA’s quarterly Strategic Analytics for Improvement and Learning reports are utilized from quarter one of 2013 to quarter 3 of 2018. These data are available on the U.S. Department of Veterans Affairs open data portal (www.data.va.gov). The unit of analysis for this study is the individual VHA medical center within the fifty United States, thus excluding the Manila and San Juan facilities. The VA states that its VHA medical centers “provide a wide range of services including traditional hospital-based services such as surgery, critical care, mental health, orthopedics, pharmacy, radiology and physical therapy” (U.S. Department of Veterans Affairs n.d.e). The sample size of this study is 3,334, consisting of 145 VHA hospital spanning the 23 quarters from 2013, Quarter 1 to 2018, Quarter 31.

Dependent Variable

The dependent variable for this study is the SAIL report patient satisfaction score. These data are extracted from the SHEP Inpatient survey, basing on the Hospital Consumer Assessment of Health Providers and Systems survey to measure patients’ perspective on hospital care (U.S.

1 Data for Clarksburg in 2017, quarter two is omitted due to an exact match with the Beckley VA facility of the same year and quarter (also the download file has “beckley” in its name when clicking on the Clarksburg download link).
This patient satisfaction score ranges from 0 to 300, with higher scores reflecting higher patient satisfaction. Due to the variability of VHA medical center reporting and the periodic amendments to the VA SAIL report form, patient satisfaction scores were not consistently reported. Since time-series analyses do not incorporate missing data, a multiple imputation technique via Amelia’s bootstrapping-based algorithms was utilized for the dependent variable. As such, Amelia “fills in data in such a way as to not change any relationships in the data but which enables the inclusion of all the observed data in the partially missing rows” (Honaker, King, and Blackwell 2017). Figure 1 displays the histogram for patient satisfaction (“patient_satisfy_i”).

![Figure 1: Histogram of Patient Satisfaction Scores](image)

**Independent Variables**

Independent variables are categories according to this study’s three research questions, VHA performance measures, VHA resources, and VHA employment satisfaction measures. This study
utilizes ten VHA performance variables, three VHA resource variables, and four VHA employment satisfaction variables. All but two of these variables are taken directly from the SAIL reports. The number of facility outpatient visits and number of inpatient beds were derived from their own published reports (available at www.data.va.gov/). Independent variable descriptions are provided below according to the given categories.

**VHA Performance measures**

First, this study utilizes ten VHA performance measures in its analyses. Due to the wait-time crisis’ national attention, which played a clear role in the call for sweeping VA reforms, this study includes two SAIL report wait-time measures. Both the primary (basic) care new patient 30-day wait-time (“waittime_primary30”) and the specialty care new patient 30-day wait-time (“waittime_spec30”) scores identify all completed appointments and the associated wait times in the 30-day timeframe (U.S. Department of Veterans Affairs n.d.f). The SAIL reports provide these data in the form of a percentage where a higher percent is preferred, indicating the success rate for meeting the 30-day care deadline.

The VHA SAIL reports include a facility efficiency score in the form of a percentage (“efficiency_rate”). The VHA efficiency rating for each facility includes clinical and administrative cost efficiency measures utilizing stochastic frontier analysis (SFA), which is a method used in assessing operational efficiency when considering quality of care (U.S. Department of Veterans Affairs n.d.f). The purpose of this model is “to estimate the optimal cost (given quality of care) after controlling for risks or confounding factors such as hospital characteristics, and separating random factors that are not under managers’ control from true managerial inefficiency” (U.S. Department of Veterans Affairs n.d.f). The inpatient “ORYX” measure is another composite score within the VA SAIL report. ORYX (not an acronym)
integrates patient outcomes of inpatient care and other performance measure data into the VHA accreditation process; therefore, organizations seeking accreditation are required to submit ORYX measure data to the Joint Commission (U.S. Department of Veterans Affairs n.d.f). Next, the outpatient healthcare effectiveness data and information set ("HEDIS") consists of two combined composite scores (lower scores preferred), each contributing equally to the final score:

HED90_1 and HED90_ec. HED90_1 averages three outpatient sample-based VHA Chart Abstracted External Peer Review Program (EPRP) composite measure scores: Behavioral Health Screening (bh90), Prevention (prv90_1) and Tobacco (smg90). Each composite (bh90, prv90_1, smg90) is calculated as the weighted numerator divided by the weighted denominator established per sampling technique. Each composite contributes equally (33.3%) to the HED90_1 Combined Composite Score because they are considered equally important to quality care (U.S. Department of Veterans Affairs n.d.f).

Next, the acute care risk adjusted length of stay ("length_of_stay") index is a sum of the actual length of stay divided by the sum of the expected length of stay for a hospital, which is then multiplied by the grand mean length of stay for all VA hospitals for the prior two years (U.S. Department of Veterans Affairs n.d.f). A lower score is preferable for the LOS variable. The patient safety index ("patient_safety_ind") is derived from a set of Agency for Healthcare Research and Quality patient safety indicators that reflect quality of care inside hospitals (and across geographic areas), focusing on potentially avoidable complications and illnesses caused by medical examination or treatment (U.S. Department of Veterans Affairs n.d.f). Two mortality rate measures are included in the SAIL reports, one reflecting a 30-day standardized ratio ("std_mortality_30day") and one reflecting the mortality rate in which patients died one day after discharge ("std_mortality_1day") from the VA medical center. Both measures are based on a rolling twelve-month period, with a reference value of 1.00 where a value of 1.20 suggests 20% more deaths occurring than expected and a value of 0.80 indicating 20% fewer deaths than expected (U.S. Department of Veterans Affairs n.d.f).
Last among the VHA performance measures is the number of outpatient visits (“\textit{out_visits}”). The VA has made available VHA medical center outpatient visit data from 2010 to 2014. Rather than selecting one year from this data (say 2014) and applying to all years included in the dataset, years 2015 to 2018 were imputed utilizing Amelia imputation software. While the VA’s annual geographic distribution of expenditures report provides a summary of the number of unique patients for the given jurisdiction, the VA outpatient visits report does not indicate that the data are limited to one visit per patient, therefore it is assumed that the VA outpatient visit data can include multiple visits by patients of a VHA medical center.

\textit{VHA Resources}

The next category of independent variables includes three VHA resource measures. The VA has published the number of inpatient beds (“\textit{inp_beds}”) available for each of the 145 VHA medical centers. This dataset includes VHA medical center inpatient bed figures from 2010 to 2014. Given that the number of VHA medical center inpatient beds changed little (if at all) from 2010 to 2014, only 2014 inpatient bed data were included in this study. Included in the SAIL report is a measure of registered nurse (RN) turnover rates (“\textit{nurse_turnover}”). This variable measures RN losses, either by termination or voluntary separation, but does not include retirements (U.S. Department of Veterans Affairs n.d.f). High employee turnover may be indicative of conflictual relationships among the staff and with managers, a (high-stress) work environment, an organization’s internal communication, and advancement opportunities (Raines 2013). Managers’ leadership capacity plays a key role in these situations. Last among the VHA resource variables is call-center response rate (“\textit{callcenter_response}”). This SAIL report score measures the average number of seconds in response to telephone calls to call centers and is
measured by: Average speed of response = \text{Sum}(Answer speed \times \text{Call volume}) / \text{Sum(Call volume)} (U.S. Department of Veterans Affairs n.d.f).

**VHA Employment Satisfaction**

The final category of independent variables includes four VHA employment satisfaction measures. Four employment satisfaction measures are available in the SAIL reports, including: overall job satisfaction (“\texttt{emp\_jobsat}”), satisfaction with (their) organization (“\texttt{emp\_orgsat}”), if an employee would recommend their organization as a good place to work (“\texttt{emp\_reccomend}”), and a Best Places to Work score (“\texttt{emp\_workplace}”) from the Federal Employee Viewpoint Survey (U.S. Department of Veterans Affairs n.d.f). The best places to work variable is scored as a percentage. The job satisfaction, satisfaction with organization, and recommendation variables are scored on a scale from 1 to 5 with a score of one being the least positive response and 5 being the most positive response.

**Results**

What VHA hospital-level determinants account for improved patient satisfaction scores following reformative VA policy decisions? This study utilizes random-effects GLS regression models to answer the research questions. Panel data between quarter 1, 2013 and quarter 3, 2018 was used to generate the given dependent and independent variables. For this study, only VHA medical centers within the 50 United States were included; therefore, San Juan, Puerto Rico and Manila, Philippines were omitted. Table 1 consists of two models. Model 1 spans from Q1, 2013 to Q4, 2015. Model 2 spans Q1, 2016 to Q3, 2018. This delineation is intended to demonstrate likely policy changes in the wake of the 2013/2014 wait-time crisis. According to the U.S. Department of Veterans Affairs (2015, p.6) MyVA Integrated Plan, the VA made improving the
veteran and (VHA) employee experience two of its proposed FY2016/FY2017 agency priority goals. Therefore, Q1, 2016 is utilized as the demarcation of key VA health care policy change.

**VHA Patient Satisfaction: 2013 to 2015**

Table 1 presents the 2013-to-2015 (Model 1) and 2016-to-2018 (Model2) regression results. In Model 1, four of the VHA medical center performance measures return significant results: 30-day specialty care wait-times, the ORYX performance composite, the 1-day standardized mortality rate, and the number of outpatient visits variable. It is worth noting for later discussion that the 30-day primary wait-time variable did not return a significant result in Model 1. Among the given VHA resources, only the number of VHA medical center inpatient beds returned significant results in Model 1. Finally, all four VHA employment satisfaction measures in Model 1 returned significant results.

**VHA Patient Satisfaction: 2016 to 2018**

Model 2 includes the same variables presented in Model 1. This time, 30-day primary care wait-times yield a significant result. On the other hand, 30-day specialty care wait-times are not significant in Model 2. The ORYX, 1-day standardized mortality rate, and outpatient visit performance measures are once again significant to patient satisfaction, and are now joined by the patient safety index. Among the VHA resource measures, the number of inpatient beds available are once again significant, and for 2016 to 2018 the call-center response rate also yields significant results. Finally, all four VHA employment satisfaction measures once again yield significant results.
Some unexpected relationships were observed in the results for both models. First, the relationship between the VHA employee job satisfaction variable and patient satisfaction produces an unexpected result within both time frames: decreased VHA employee job satisfaction is likely to occur as patient satisfaction scores increase. As well, VHA employee satisfaction with (their) organization produced a similar relationship with patient satisfaction. In contrast, VHA employees are more likely to be satisfied with their workplace and more likely to
recommend the VHA as patient satisfaction scores increase. Why this may be the case will be discussed further in the next section. Second, patient satisfaction is likely to increase as the patient safety index decreases. Lastly, patient satisfaction is likely to increase as the number of available inpatient beds decreases. These unexpected relationships will also be discussed in the next section.

Discussion and Conclusions

Discussion

This study finds mixed support for its hypotheses. For hypothesis H1, the ORYX measure may indicate some level of consistency within the VHA when providing care for patience once they are able to be seen. Considering the 2013/2014 wait-time crisis, the ORYX seems unlikely to reflect factors that lead to the crisis. With regards to 30-day primary care wait-times, the lack of statistical significance seen from 2013 to 2015, followed by statistical significance from 2016 to 2018 may be indicative of the widespread misreporting of VHA primary care wait-times. If these data were misreported prior to key VA policy reforms, it may be reasonable to expect an insignificant relationship between 30-day primary wait-times and patient satisfaction scores. However, once VA reforms were implemented to address misreported wait-time practices and improve veterans’ VHA experiences, it may be reasonable to expect 30-day primary care wait-times to be a significant factor in patient satisfaction scores.

For hypothesis H2, the number of inpatient beds may be indicative of unique VHA medical center attributes that influence patient satisfaction scores. If the number of inpatient beds is likely to be lower as patient satisfaction scores increase, could this be an indication that veterans are less likely to have a better VHA experience at larger medical centers? Further research would aid in answering this question. Regarding call-center response rates, two possibilities are worth
considering, given the results. Could the significance of call-center response rates be a result of VA policy geared towards an improved veteran experience, or could it be the result of heightened patient awareness of the VHA’s difficulties due to the exposure of the wait-time crisis? Finally, the lack of statistical significance for RN turnover rates may indicate some measure of stability within the VHA nursing corps; however, this does not appear to be a viable proxy for the (reported) overall VHA staffing woes.

For hypothesis H3, VHA employment satisfaction measures have a clear impact on patient satisfaction scores; however, two of the four did not reflect significant results in the direction anticipated. First, why does the VHA job satisfaction variable have such a strongly negative relationship to patient satisfaction scores? Do veteran patients simply have high expectations of their VHA medical center’s staff, to the degree that meeting those high expectations lead to employee dissatisfaction (or even burn out)? On the other hand, do VHA medical center staffers hold job expectations that are not reflective of the typical VHA work environment? Perhaps the answer is that one or both are accurate. Perhaps there is another explanation.

When considering the remaining employment satisfaction variables, keeping in mind the job satisfaction results, why might VHA employees be less likely to feel satisfaction with their organization as patient satisfaction scores increase, yet be more likely to feel good about their workplace and recommend it to others as patient satisfaction scores increase? If the workplace is generally viewed as favorable, enough that VHA employees are willing to recommend it to others, yet they are less likely to be satisfied with their organization and less likely to feel satisfied with their job, could this be indicative of an employee base that is invested in providing quality care to their clientele yet frustrated with their organization’s policies that employees are suffering from job dissatisfaction in their efforts to provide veterans with quality care? This
would likely be a preferred explanation for veterans and the VA, as opposed to a generally disgruntled and complacent VHA workforce. Further research may help answer these questions.

**Limitations**

Foremost among the limitations of this study is the frequency with which VA SAIL reports have been amended since 2013, quarter 1. Since 2013, several measures found on quarter 1 reports have been discontinued. As well, several new measures have been added to the reports since then. Fortunately, data are consistent within each batch of quarterly reports. As well, a few measures made available from 2013 to 2018 were calculated differently after a certain point during that time span. Within this study, these measures were avoided as much as possible.

Second, many of the measures included within this study were composite scores consisting of several measures from additional VA surveys and reports. Knowledge of these surveys and reports is limited to what is provided within VA SAIL report definitions. For each measure on the SAIL reports, a range and a directional indicator for the preferred score was provided to inform those wishing to utilize the reports. While this is helpful for use with secondary analyses, data transparency is limited.

Finally, limitations on data accessibility resulted in two approaches worth reiterating. First, available data sorted by VHA medical facility is limited. Much of the analyses are limited to data within the SAIL reports. Only the number of VHA outpatient visit and inpatient beds by VHA medical facility were available outside of the SAIL reports. Second, 2014 data for VHA medical center inpatient beds was utilized for all years within this study. Given that the change in number of inpatient beds from year-to-year appeared nominal, 2014 data was chosen over imputation. Lastly, Amelia’s bootstrapping-based algorithms was utilized for the patient satisfaction and
VHA medical center outpatient visits variables. While this technique is said to not influence the final analyses, its utilization must be considered a noteworthy limitation.

Conclusions

When examining VHA medical center patient satisfaction scores during and after the wait-time crisis, patterns of influence among VHA performance scores, VHA resources, and VHA employment satisfaction scores. Though customer satisfaction is often a driving factor for most industries, the VHA’s ORYX performance scores indicate efforts within the VA to provide a quality of care standard that not only yields positive patient satisfaction scores but also suffices facility accreditation standards. To the VA’s benefit, the two seem to go hand-in-hand. However, the ORYX score seems to only be applicable to patients already in the VHA system. For veterans wishing to receive care from the VHA, the wait-time until their first primary care visit is significant, not only to their rating of VHA facilities, but to their overall well-being. When the stakes are at their highest (i.e. the standardized mortality rate), veterans may (in part) be taking their cues from the notorious Phoenix VHA hospital case study.

While VHA resource availability may have been addressed via the 2016 implementation of Secretary McDonald’s MyVA initiate, employment satisfaction projects a clear influence on patient satisfaction scores. As a service-oriented industry, VA health care requires a great amount of customer service, naturally resulting in frequent patient-VHA staff interactions. As the face of the VHA, medical center staff represent VA health care policies in action. The compatibility between policy and staff is likely to play a vital role in what price customers are willing to pay (direct or indirect) for a firm’s product. For the VA, its health care policies are likely to set the tone for how VHA employees represent the firm’s product to the customer.
What do the conclusions of this study mean for the VHA process at large? Rothschild’s one-armed bandit theory appears to hold up well when considering the VA’s Strategic Analytics for Improvement and Learning performance reports. As well, Keller and Raddy’s monopolist extension of Rothschild’s one-armed bandit problem in economics is viable given the VA’s relative monopoly on veteran health care. Many veterans simply do not have an affordable alternative. In lieu of the VA’s recent wait-time crisis, and its efforts to implement policy reforms designed to provide a greatly improved veteran health care experience, the VA appears to be in the midst of a bandit problem to locate its maximum expected profits when facing an unknown and changing veteran health care demand function. Department of Veterans Affairs policies geared towards VHA performance, resources, and employment satisfaction appear to be intertwined with the veteran health care experience. Despite swirling rumors about privatizing the VA and denials of such efforts from key administrative officials (Lima 2018), the VA is likely to achieve a better price for its product through a well-informed set of choices that aid in move post-wait-time crisis VHA policy from exploration to exploitation.
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