Organizational-level Predictors of Burnout in the Primary Care Workforce at the Veterans Health Administration

Allyson W. O'Connor

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Reading Committee:

Christian D. Helfrich, Co-Chair

Edwin S. Wong, Co-Chair

Karin M. Nelson

Jeanne M. Sears

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Allyson W. O'Connor

University of Washington

Abstract

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Allyson W. O'Connor

Chairs of Supervisory Committee:
Christian D. Helfrich, Research Associate Professor
Edwin S. Wong, Research Associate Professor
Department of Health Systems and Population Health

Burnout, an occupational problem associated with workplace stress, is common in health care. Most burnout research focuses on assessing and treating predictors of burnout among individuals, yet many precursors to burnout stem from organizational policies, practices, and work systems. Addressing organizational-level predictors of burnout, rather than emphasizing individual transformation, may alleviate the job demands predictive of burnout, benefiting the workforce – and health systems – at large. This research tested associations between changes in three potential burnout predictors in primary care staff at the Veterans Health Administration (VHA). Using aggregated, annual All Employee Survey data from the VHA, we tested burnout in response to changes in (1) Veteran patient enrollment levels at VHA facilities for primary care team staff members, (2) electronic health record notification volume for primary care providers, and (3) full practice authority for VHA nurse practitioners. All three predictors reflected large-scale, health system-wide changes in workload, type of work, and professional autonomy. We found limited evidence of associations between these predictors and burnout when measured at

the VHA facility level; only nurse burnout was associated with changes in patient enrollment. While this research contributes to the limited evidence on organizational-level burnout predictors, these associations may be different when burnout is measured at the individual or team – rather than aggregate – level.

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Chapter 1. INTRODUCTION

1.1 BURNOUT IN HEALTH CARE: A SILENT CRISIS

Burnout is an occupational problem characterized by physical, mental, and emotional responses to stressors at work[1,2] and is considered “a silent crisis” in health care.[3,4] Healthcare workers face some of the highest levels of burnout in any industry,[5] and burnout is a critical concern for the health and occupational well-being of workers and for organizational health. Generally referred to as the three “domains” of burnout, burnout often manifests as (1) emotional exhaustion, or loss of compassionate energy, (2) depersonalization, or a sense of cynicism towards work, and (3) reduced achievement, or feelings of reduced effectiveness or accomplishment at work.[2,6] For health care workers, burnout may include detachment from work, insensitivity towards patients, and negativity at work among other feelings and behaviors.[2] Stressors associated with burnout in health care, while common, may be challenging to change, and workers may learn to tolerate burnout symptoms, with potential consequences for workers, patients, and health systems.[3]

Burnout is a common experience in health care and is particularly prevalent in clinical settings. Prior research indicates roughly half of physicians experienced burnout from 2011 to 2020.[7] Notably, burnout in primary care is among the highest for all medical specialties. In the United States (U.S.), primary care physician burnout is estimated at or above 50% and growing.[8,9] Nurse burnout in primary care is also prevalent. In a meta-analysis of primary care nursing, high emotional exhaustion was observed in 28% of primary care nurses in the U.S., 15% experienced depersonalization, and 31% experienced reduced achievement.[10]

While a critical concern for worker health and well-being, the effects of burnout extend beyond adverse effects on individual health. Burnout is also associated with adverse workforce,

patient care, and organizational outcomes.[5,11,12] In healthcare workers, health effects of burnout include increased risk of sleep disturbances, headaches, musculoskeletal disorders in women, and cardiovascular diseases in men, depression, suicidal ideation, and relationship problems.[13–17] Additionally, burnout is associated with working while ill, reduced work hours, intention-to-quit, and turnover; and burnout may influence quality of care and patient safety.[18–22] For healthcare organizations, replacing physicians and other healthcare professionals with newly hired and trained staff can be a serious financial burden and challenge in the face of healthcare worker shortages.[23,24]

1.2 PREDICTORS OF BURNOUT

Job demands and the resources available to workers may predict burnout.[5] Predictors of burnout in health care stem from the complex work environment and patient care demands that are challenging to clinical care staff. In health care, burnout predictors include high workloads (including perceived workload), long work hours, low autonomy, understaffing, and ambiguity in one's job role.[5,8,25–30] Burnout is also associated with increasing digital work in health care, particularly from electronic health record (EHR) systems. The burden of digital work, which may detract from direct patient care tasks and disrupt work-life balance, was associated with dissatisfaction and burnout in previous qualitative and quantitative studies.[8,31–33] Other aspects of work act as job resources and may alleviate burnout by reducing job demands, such as through increased autonomy and social support.[5]

Most evidence on burnout among healthcare workers comes from cross-sectional studies measuring individual-level stress reactions to job demands.[4,8] This type of research adds to evidence on burnout antecedents, i.e., workplace factors that are precursors or predictors of

burnout, and may inform potential ways to intervene on burnout. However, stressors associated with burnout are often determined by organizational-level structures, policies, and work systems.[1] To date, few studies have assessed organizational-level antecedents to burnout or burnout interventions implemented at the health system or health facility levels.[34] Though, recent systematic reviews identified a few promising studies associating improvements to clinical workflow with reduced burnout and held promise for individual-level interventions being scaled up to the organizational level.[35,36] Identifying and assessing organizational-level determinants is key to our understanding of burnout. This is particularly true at the worker population-level, since many organizational policies affect groups of workers.

In healthcare, large-scale organizational-level changes in patient populations, work processes, and policies are common, but their effect on burnout is largely unknown.[34] This research aims to assess changes in organizational characteristics at the health facility level to test their associations with burnout among the clinical workforce. This approach may clarify systems drivers of burnout and inform potential solutions to burnout.[1] To do this, we identified organizational-level changes at a health system which corresponded to well-established workplace burnout predictors like workload and autonomy.

1.3 THE VETERANS HEALTH ADMINISTRATION SETTING

As one of the largest health systems in the U.S., the Veterans Health Administration (VHA) offers a unique opportunity to study the healthcare workforce on a national scale. Across, the U.S., the VHA employs over 300,000 people[37,38] who serve an estimated nine million Veterans per year.[39] Veterans who enroll in VHA care at one of over a hundred VHA facilities nationwide are assigned to a primary care team. Primary care is often a Veteran patient's first contact with a

health system. Primary care staff deliver long-term comprehensive care for Veterans' healthcare needs and coordinate VHA specialty care for more complex issues.[40] In 2010, the VHA implemented a patient-centered medical home model of primary care delivery.[41] Within this structure, primary care staff were organized into Patient-Aligned Care Teams, or PACTs, which are assigned a panel of enrolled patients. There are four key roles within a PACT: primary care providers (PCPs), nurse care managers (e.g., registered nurses), clinical associates (e.g., medical assistants), and administrative clerks. For primary care staff, the rigors and structure of primary care may contribute to burnout.

Recent changes in VHA primary care offer the opportunity to study associations between organizational-level changes and burnout. While there are important differences between the VHA health system and other health systems in the U.S., burnout prevalences among primary care staff at the VHA are like those at non-VHA settings. For example, among physicians at the VHA, burnout among primary care physicians – approximately 50% – was similar to burnout prevalences observed elsewhere.[42] A non-VHA study observed similarly high burnout among family and general internal medicine physicians compared to most other specialties.[43]

While many burnout studies focus on physician burnout, less is known about burnout among other clinical staff. Staff in non-physician clinical roles also experience notable burnout. A 2017 study of VHA PACT members observed an overall burnout prevalence of 41% across primary care personnel.[44] However, burnout percentages varied from 28.5% to 58.6% depending on whether the team was fully staffed or experienced turnover or patient panel overcapacity.[25] The VHA offers the opportunity to study burnout among multiple clinical roles affected by ongoing changes in health care delivery and practice.

1.4 ORGANIZATIONAL CHANGES AT THE VHA

In health care, large-scale organizational-level changes in patient populations, work processes, and policies are common, but their effect on burnout is largely unknown.[34] In recent years, the VHA experienced health system-wide changes in volume of Veterans enrolled at VHA facilities, modifications to EHR-based information management systems, and implementation of nurse practitioner (NP) independent practice licensing. These changes affected the primary care work environment, though the effect of these changes on burnout in the primary care workforce is undetermined.

At the VHA, recent evidence showed that the Veteran population grew unevenly throughout the U.S., with some regions of the country experiencing rapid and substantial growth.[45] Patient enrollment at VHA facilities is affected by geographic shifts in Veteran residence, which could create disparities in workload for healthcare staff across the VHA system. While excessive workloads are a well-substantiated predictor of burnout,[13,46] there is little evidence on patient enrollment volume at health facilities and burnout. Though, the 2017 VHA study previously discussed found that patient panel overcapacity, or PACT members caring for a greater than the typical population of patients, was correlated with increased burnout in primary care.[25] This study was cross-sectional, though, which brings into question temporality of the patient volume exposure and the burnout outcome. It is unknown whether increases or decreases in patient enrollment volume –one aspect of patient-related workload for health care staff – relate to burnout in primary care.

Another VHA-wide change was related to changes in the volume of notifications PCPs received through the VHA's EHR system. EHR systems are an increasingly important aspect of patient care management in health care. However, the substantial time investment required to

operate EHRs can be a source of stress and job dissatisfaction for healthcare staff, particularly providers.[8,47,48] Inefficient EHR systems create digital work burden for providers, which may contribute to burnout,[49,50] PCPs receive notifications of test results, referrals, medication refills, and other messages through their electronic inboxes,[51] and managing these notifications can be cumbersome. One study found that primary care physicians spent 85 minutes per day on inbox management.[52] Few recent studies have associated EHR improvements with burnout, though a systematic review found that recent studies to improve EHR efficiency did not alleviate burnout.[35]

In 2017, the VHA implemented the View Alert Optimization Program, an initiative across all VHA facilities to improve EHR efficiency for PCPs and reduce the number of mandatory EHR-based inbox notifications they received daily.[53,54] An analysis of the intervention observed large decreases and increases in notification volumes for PCPs. It was this variability in notification volume change after the initiative which provided a natural experiment to test the association between changes in notification volume and burnout. Findings could inform the likelihood of a dose-response relationship for reducing EHR digital burden from notifications.

Another large-scale changes at the VHA influenced practice authority for nurse practitioners (NPs). A recent VHA regulation licensing all VHA NPs as independent practitioners influenced another a potential burnout predictor: professional autonomy. For NPs, the autonomy with which they practice is largely dictated by practice authority policies defining the services an NP may legally provide. State-level policies traditionally regulate NP practice authority, and these policies describe restrictions to NP practice. In reduced or restricted practice authority states, physician collaboration requirements or restrictions on prescribing authority for

NPs are common. Other states regulate full practice authority (FPA) where NPs may practice as independent practitioners, except when prescribing controlled substances in some cases.[55–57]

In 2017, the VHA licensed all VHA NPs with FPA regardless of the state where they held an NP license.[58] NPs practicing under reduced or restricted practice authority licenses gained independent practice rights. While NP independent practice is associated with many benefits to patients and health systems, such as through improved access to care,[59] independent practice also benefits NPs who may practice to the full extent of their education and training.[56] Prior research found that favorable practice environments with FPA offered NPs the most autonomy and were associated with greater job satisfaction and reduced burnout.[60,61] However, little is known about how NP burnout might be affected after a change from reduced or restricted practice authority to FPA. This VHA policy change offered a unique opportunity to compare NP burnout at VHA facilities in states where NPs practice restrictions were lifted to NPs in states with FPA prior to the regulation.

These three large changes which occurred at the VHA provided natural experiments for testing organizational-level changes and burnout in primary care. Along with providing top-quality health care for Veterans, the VHA 2018-2024 Strategic Plan listed attracting and retaining highly qualified employees as an organizational focus,[62] and addressing burnout is critical to this goal.[63] Findings in this research could inform health systems, like the VHA, on potential organizational policies and interventions to reduce burnout and maintain a healthy workforce. This research also sought to add to the sparse evidence on associations between organizational-level changes in the healthcare work environment and burnout among primary care worker populations.

1.5 CONCEPTUAL FRAMEWORK

The Job Demands-Resources (JD-R) model of occupational well-being is an often-used framework for burnout, which categorizes work characteristics into either job demands or job resources. Burnout is classically conceptualized as an imbalance between job demands and the resources workers have for managing job stressors.[13] The simplest, and most common, interpretation of the JD-R model is that the energy workers expend on job demands increases burnout (e.g., through emotional exhaustion). Additionally, the availability of job resources may alleviate the adverse effects of job demands on burnout.[13]

The JD-R model is flexible for understanding burnout in a variety of work environments and occupations,[13] and it is well suited to the healthcare work environment. The theory underlying this research asserts that organizational-level factors in health care may be associated with burnout by increasing job demands and reducing job resources. While the JD-R model is commonly applied to individual-level associations, the conceptual model in Figure 1 applies the JD-R theory to our research. We adapted this model to include organizational-level factors which act as precursors to job demands and resources associated with burnout. Organizational-level factors include structures and characteristics of health systems, organizational policies, and work systems. While not explicitly studied in this research, note that our J D-R model also includes work engagement. Work engagement is the opposite of burnout, where work is seen as challenging rather than stressful or demanding.[13,64] Also, job resources are most strongly predictive of work engagement.[13] The model also included worker resources which may influence the resources workers have on the job.

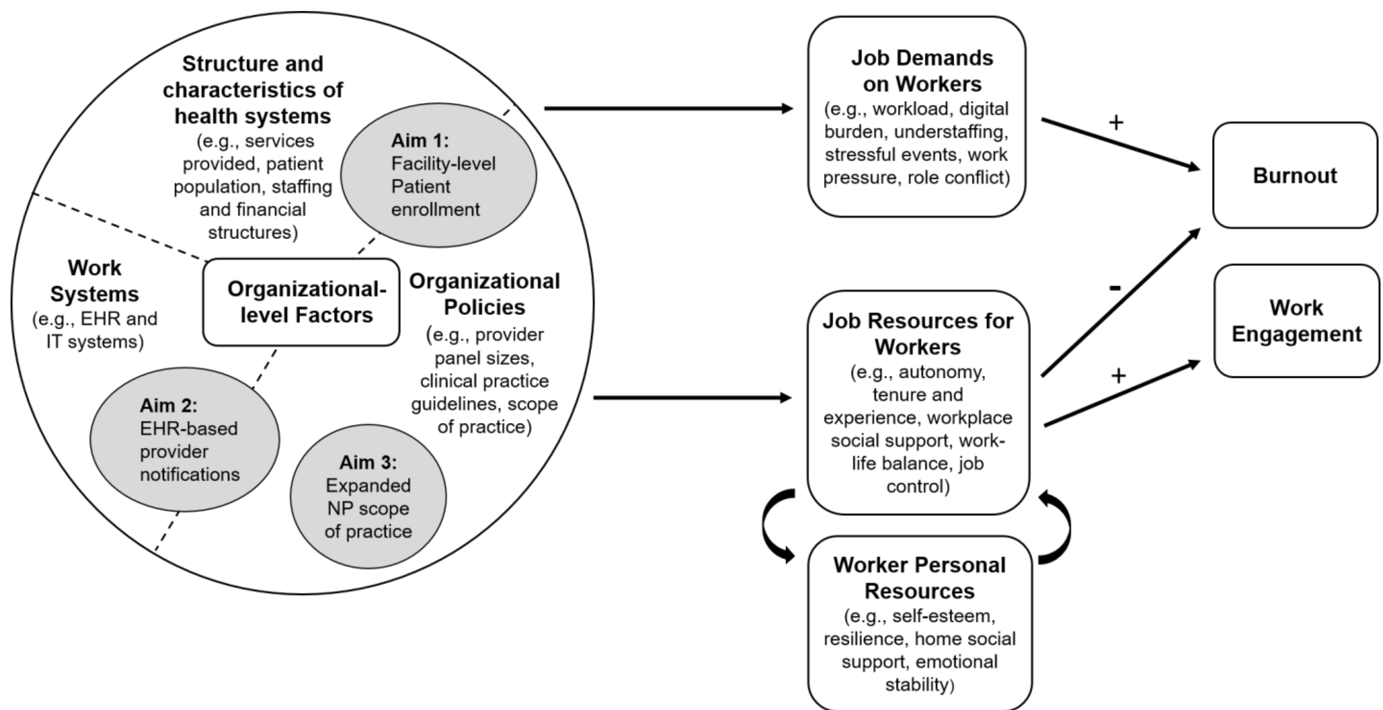

Figure 1.1 Job Demands-Resource model of organizational-level factors in healthcare associated with burnout

In this research, we hypothesized how organizational-level changes within the VHA would be associated with job demands, job resources, and burnout. Each of our three aims covered changes at the VHA which affected the organization in a broad way. In Aim 1, patient enrollment volume at the facility level affected the number of patients distributed across the primary care workforce. Growth in patient enrollment volume was hypothesized to increase job demands for clinical staff, subsequently leading to burnout. For Aim 2, after the notification initiative, declines in notification volumes may have alleviated job demands and associated burnout. We hypothesized that a decrease in the digital burden created by EHR-based work systems would be associated with a decrease in provider burnout. In Aim 3, we studied increased autonomy among NPs, with autonomy representing a job resource. In this aim, NP FPA was hypothesized as a source of autonomy associated which would be associated with reduced

burnout among NPs. Each of these three organizational changes at the VHA impacted the job demands and resources for VHA primary care staff, depending on clinical role. We assessed burnout as an outcome at the population level through estimating burnout prevalences at VHA facilities.

1.6 INNOVATION

All three aims of this research capitalized on substantial health system-wide natural experiments in patient-related workload, digital work burden, and provider autonomy at the VHA—changes which parallel trends in the healthcare industry nationwide. In this research, we built on the substantive body of cross-sectional burnout research by studying changes in burnout with serial cross-sectional study designs. Most burnout research relies on cross-sectional observations which are subject to confounding and thus inadequate for assessing causal relationships. This research, in contrast, used longitudinal data sets created from serial cross-sectional VHA survey data to test changes in burnout attributable to the three organizational factors of interest.[8]

Aim 1 specifically examined patient enrollment as an organizational-level determinant of burnout. While substantial evidence associates workload in healthcare with burnout, to our knowledge there was little research on the effect patient enrollment growth on burnout. Additionally, most healthcare burnout research has focused on physicians. Though physicians often report the highest levels of burnout, burnout is also prevalent among non-provider clinical staff, non-clinical staff, and office staff in primary care.[65] We aimed to expand the field of burnout research by studying workers in other clinical occupations, like medical assistants, and administrative staff in primary care teams. Aim 2, to our knowledge, was also the first study at to

assess a change in the volume of electronic alerts on PCP burnout. Aim 3 tested associations between NP practice independence and burnout. To date, this was the first study to test the effect of a change from reduce or restricted practice authority to FPA on NP burnout, particularly in a national sample of NPs.

1.7 SPECIFIC AIMS

AIM 1: Test the association between facility-level changes in Veteran patient enrollment on burnout in primary care staff. Geographic shifts in the VHA patient population between 2013-2018 offered a natural experiment for testing the association between changes in patient enrollment (i.e., the ratio of Veterans enrolled in VHA care to providers at a facility) and burnout among primary care staff. In this serial cross-sectional analysis, burnout was hypothesized to be positively associated with (1) an increase in the number of enrollees per provider and (2) an increase in the year-over-year change in enrollees per provider at VHA facilities.

AIM 2: Test the effect of changes in electronic inbox notification volume on PCP burnout. EHR-based inbox alerts notify PCPs of completed and in-progress patient-related tasks. In 2017, the VHA implemented an intervention to improve efficiency of inbox notifications for PCPs by eliminating low-value notifications and allowing PCPs to personalize non-mandatory notification types. Mean changes in notification volume varied widely among VHA facilities. We tested post-intervention changes in burnout associated with the change in the number of daily notifications per PCP at a VHA facility. We hypothesized that notifications reductions would be associated with reduced PCP burnout.

AIM 3: Test the association between increased independent practice authority for NPs on NP burnout. The VHA designated all VHA NPs as licensed independent practitioners in 2017. NPs licensed in states which previous regulated reduced or restricted practice authority for NPs gained FPA under this federal VHA-specific regulation. We used a difference-in-differences approach to test the effect of a change from reduced or restricted to FPA on NP burnout. We hypothesized that NP burnout would decrease for VHA facilities previously regulated by reduced or restricted NP practice authority compared to NP burnout at facilities in states which operated under FPA prior to the regulatory change.

Chapter 2. PATIENT ENROLLMENT GROWTH AND BURNOUT IN PRIMARY CARE AT THE VETERANS HEALTH ADMINISTRATION

2.1 INTRODUCTION

Burnout among health care workers is a pervasive occupational problem that has adverse consequences for workers and health systems. Health care faces some of the highest levels of burnout of any industry in the United States (U.S.)[12] Fifty percent of primary care physicians and one-third of nurses working in direct patient care experiencing burnout symptoms.[43,66,67] Commonly characterized as a response to stressors at work,[1,2] burnout affects mental and physical health, reduces job satisfaction, and is associated with turnover intentions among health care workers.[8,13–15,68] For healthcare organizations, burnout threatens the stability of the workforce, and hiring and training new staff can be both costly and challenging in the face of healthcare worker shortages.[23,24] Additionally, provider turnover may impair patient access to care,[69] and patient safety and quality of care may be adversely associated with burnout among health care personnel."[26,70–72]

Burnout is thought to result, in part, from excessive workloads. Studies have found that workload is associated with burnout among clinicians[25,27,29,30] and nurses.[26] In particular, high intensity work,[8] greater burden of computer-based clerical tasks,[68] high perceived workloads,[27,29] understaffing,[25,26] and excessive panel sizes, i.e., the number of patients under a provider's care,[25] were associated with health care burnout. Though evidence suggests that individual autonomy and control over workload may mitigate burnout,[27,66] some aspects of workload associated with burnout are governed by organizational capacity and policies. The effort required

to do one's job defines workload; yet, identifying single, direct measures of workload is challenging in burnout research.

One potential determinant of workload for health care personnel is patient enrollment, or the number of patients enrolled in care that a health system is responsible for providing care to. The Veterans Health Administration (VHA) is one of the largest integrated health systems in the U.S. and uses patient enrollment information, or the number of Veterans registered for care at a VHA facility, to make projections on patient access, utilization, cost.[73] At the VHA, patients are assigned to the health care teams; but at the organizational-level, patient enrollment may act as a metric of health system demand. Primary care provides preventive care and serves as a front line to other services in the VHA. While some Veterans may not be active users, VHA (and the team their assigned to) will still be responsible for providing care if and when Veterans decide to receive it. Overall demand for care at a facility may affect patient-related workload for its staff.[23]

In this study, we focused on the primary care sector, and VHA patient enrollment served as an indicator of overall workload distributed across the VHA's primary care teams. Veteran enrollment in care at local VHA facilities varies substantially nationwide, and with it, the ratio of Veteran enrollees to health care staff at each facility. While Veteran demand for VHA services is increasing overall, some VHA medical facilities are losing enrollment as others grow rapidly.[74] Evaluating the effect of changes in patient enrollment at the organizational level, such as when enrollment in the health system care grows, has operational meaningfulness, and may help health systems like the VHA anticipate effects on burnout in their workforce. In burnout research, the lack of longitudinal studies limits determination of causal relationships between predictors and burnout, particularly at the organizational level. Also, the effects of large-scale organizational changes in workload on burnout – as opposed to individual or team level changes – are largely

unknown.[34] In this study, we used serial cross-sectional measures of organizational change in patient enrollment to address these gaps by testing the association between variation in patient enrollment volume across the VHA over time and burnout among primary care staff.

2.2 METHODS

2.2.1 Study Design and Data Sources

For this study, data on Veteran patient enrollment for 138 VHA facilities nationwide were linked with estimates of burnout among primary care staff at each facility from 2014-2018.[29,42] Each VHA facility constitutes a regional network of one or more medical centers and community-based outpatient clinics. Patient enrollment and primary care staffing levels for each VHA facility were derived from the VHA's Support Service Center (VSSC) Capital Assets database. These estimates were available for late September during each year of the study period at the close of the VHA's fiscal year.

Facility-level estimates of burnout were derived from the VHA's All Employee Survey (AES), a workforce survey offered to VHA employees each spring. The AES assesses workplace climate, employee attitudes, and occupational outcomes, such as burnout.[75] Overall response rate for the AES among Veterans Health Administration employees was 56% in 2013, 56% in 2014, 60% in 2015, 57% in 2016, 60% in 2017, and 62% in 2018.[76–78] In 2018, 210,057 employees responded to the AES.[78] Individual survey responses and respondent characteristics were averaged to provide estimates for each facility's burnout levels and workforce characteristics for each year of the study, i.e., facility-year estimates. To create the serial cross-sectional data set, facility-year survey measures were linked with facility-level enrollment and staffing data by facility identifier.

2.2.2 Study Population

Within the VHA's patient-centered medical home model, primary care clinical staff are organized into four-person teams known as patient-aligned care teams, or PACTs.[79] There may be dozens to hundreds of PACTs at a VHA facility (depending on facility size and complexity), and every VHA patient is assigned to a PACT for their primary care. Our study population included AES respondents who indicated being part of a PACT and being in one of four key primary care roles: (1) primary care provider (physician, nurse practitioner [NP], or physician assistant [PA]), (2) registered nurse [RN], (3) clinical associate (licensed practical nurse, nursing assistant, intermediate care technician, or health technician), and (4) administrative clerk. Occupation and PACT membership were provided by the survey respondent. The final sample included 82,421 survey respondents aggregated into facility-level means or proportions by primary care role for each survey year. There were 2,760 facility-year observations included in this study. To comply with data use requirements, a minimum of 10 respondents were required for each aggregate measure, resulting in the exclusion of 8.8% of facility-year observations.

2.2.3 Measures

Veterans discharged from military service for any reason other than dishonorable may actively enroll in VHA health care if they meet income and disability criteria.[80] For this study, VHA enrollment was measured as the ratio of enrolled patients at a VHA facility to the number of full-time equivalent (FTE) primary care providers (PCPs) at that facility each year (i.e., enrollees/PCP). Though VHA enrollees may receive care anywhere in the VHA, they generally receive primary care from an assigned primary care team at their preferred VHA facility. Not all

enrollees use VHA care in a year, or they may use specific VHA services (e.g., pharmacy) without using primary care services. We used enrollment to approximate the potential workload of VHA primary care staff. Facility-level enrollment counts were extracted for enrollees' preferred facilities – as opposed to closest facility – to approximate the clinical workload for primary care teams based on where patients were most likely to receive care. Two predictors based on enrollment ratios were used in this study: (1) the absolute enrollment measure (facility-level enrollees/PCP); and (2) the enrollment change measure (calculated as the percentage change in enrollees/PCP since the previous year at a facility).

The primary outcome in this study was the prevalence of burnout for each primary care role. The AES utilizes three questions to characterize common dimensions of burnout modeled after Maslach Burnout Inventory (MBI):[81,82] (1) emotional exhaustion ("I feel burned out from my work"), (2) depersonalization ("I worry that this job is hardening me emotionally"), and (3) reduced achievement (a reverse scored answer to, "I have accomplished many worthwhile things in this job").[83] Survey respondents answered these questions using a seven-point Likert scale of the frequency of burnout symptoms, ranging from never to every day. To align with previous evidence in the literature, we constructed a composite measure of burnout by combining the emotional exhaustion and depersonalization questions to identify respondents reporting burnout.[29,42,84] Previous research promotes use of these two items in reliably assessing burnout compared to the MBI, which is the gold standard of validated burnout assessment tools.[84] Respondents screened affirmatively for burnout when they answered weekly or more often to the emotional exhaustion and/or the depersonalization questions.[82,84] Burnout was calculated as the proportion of survey respondents reporting burnout within each primary care role at a facility.

Facility-level demographic characteristics were calculated for primary care role, including gender (proportion of respondents who were female), age category (proportion of respondents who were less than 50 years old), and short tenure (proportion of respondents who worked at the VHA for less than 5 years). Levels of support staff were defined as the ratio of clinical and administrative support staff per FTE PCP (i.e., support staff/PCP). The VHA target ratio is three support staff/PCP. Indicators for each calendar year (2014-2018) were included to assess time trends.

2.2.4 Statistical Analyses

Descriptive statistics were estimated for VHA facilities for each year in the study. We used fixed effects linear regression models to estimate the association between enrollment and burnout within facilities for each PACT role. These models accounted for the multi-year structure of the data and controlled for bias due to time-invariant confounding by estimating within-facility effects of enrollment on burnout. For the absolute enrollment effect, unadjusted models (Model group 1) and adjusted models (Model group 2) estimated the effect of a change of 100 enrollees per FTE PCP on burnout for each role. We also analyzed a relative measure of change in enrollment to test the effect of magnitude of change from one year to the next, regardless of absolute enrollment levels. For the relative enrollment effect, base unadjusted models (Model group 3) and adjusted models (Model group 4) estimated the effect of a 1% year-over-year change in the number of enrollees/PCP on burnout for each role. Adjusted models included gender, age category, and tenure for the PACT role analyzed; year indicators; and the support staff ratio at the facility. All models utilized cluster robust standard errors. This study

was approved by the VHA Puget Sound and University of Washington Institutional Review Boards. All analyses were performed using Stata software (version 16.1).[85]

2.3 RESULTS

Table 2.1 reports facility characteristics for the 138 VHA facilities included in this study. Response to the AES increased from 14,795 primary care respondents in 2014 to 18,541 respondents in 2018. Based on survey response, primary care staff was predominantly female in all roles. The populations of PCPs and nurses were older than those of clinical associates and administrative clerks, and the proportion of clinical associates and administrative clerks with short VHA tenure (less than 5 years) was greater than for PCPs and nurses. The ratio of support staff for PCPs increased from 2.5 support staff/PCP in 2014 to 3.1 support staff/PCP in 2018.

Mean Veteran patient enrollment decreased at the VHA over the study period (Appendix Figure 2.A1). While mean enrollment averaged approximately 65,000 enrollees per VHA facility from 2014-2018, the mean enrollment ratio at VHA facilities decreased from a mean of 1,450 enrollees/PCP in 2014 to 1,340 in 2018. Thirty-eight facilities experienced increased enrollment (mean of 1,435 enrollees/PCP in 2014 to 1,578 in 2018), and 100 facilities experienced decreased enrollment (mean of 1,456 enrollees/PCP in 2014 to 1,249 in 2018). Median year-over-year change in enrollees/PCP decreased over the study period. Median enrollees/PCP decreased 0.74% in 2015 compared to 2014 [Inter-quartile range (IQR): -5.32% to 4.49%] and decreased 2.72% in 2018 compared to 2017 (IQR: -6.47 to 2.38) (Table 2.1).

The prevalence of burnout for all PACT roles increased in the first two years of the study then began to decline after 2016 (Figure 2.1). This equated to an overall decrease throughout the study period. From 2014 to 2018, mean burnout at VHA facilities decreased from 51.7% to

43.8% among PCPs, from 37.4% to 33.9% among nurses, from 32.0% to 29.4% among clinical associates, and from 41.5% to 36.3% among administrative clerks.

Table 2.1. Characteristics of VHA facilities from 2014-2018 (n=138)

	Year				
	2014	**2015**	**2016**	**2017**	**2018**
AES* respondents, n (%)					
Total primary care staff	14,795	16,938	15,355	16,792	18,541
PCP†	2,701 (18)	3,035 (18)	2,876 (19)	3,345 (20)	3,583 (19)
Nurse care manager	5,021 (34)	5,352 (32)	5,096 (33)	5,291 (32)	5,714 (31)
Clinical associate	4,181 (28)	4,533 (27)	4,285 (28)	4,450 (27)	4,943 (27)
Administrative clerk	2,892 (20)	4,018 (24)	3,098 (20)	3,616 (22)	4,301 (23)
Proportion of AES respondents at a facility who were female, mean (SD)					
PCP	0.55 (0.12)	0.54 (0.13)	0.54 (0.13)	0.54 (0.12)	0.56 (0.11)
Nurse care manager	0.84 (0.073)	0.81 (0.081)	0.80 (0.084)	0.81(0.13)	0.81 (0.079)
Clinical associate	0.80 (0.1)	0.78 (0.092)	0.77 (0.1)	0.79 (0.11)	0.81 (0.097)
Administrative clerk	0.65 (0.14)	0.62 (0.15)	0.69 (0.16)	0.70 (0.13)	0.72 (0.12)
Proportion of AES respondents at a facility aged <50 years, mean (SD)					
PCP	0.41 (0.14)	0.4 (0.14)	0.39 (0.13)	0.38 (0.14)	0.41 (0.15)
Nurse care manager	0.46 (0.12)	0.48 (0.11)	0.48 (0.13)	0.49 (0.11)	0.49 (0.12)
Clinical associate	0.5 (0.11)	0.52 (0.12)	0.52 (0.11)	0.52 (0.11)	0.52 (0.13)
Administrative clerk	0.57 (0.14)	0.55 (0.12)	0.59 (0.13)	0.59 (0.13)	0.6 (0.13)
Proportion of AES respondents at a facility with short tenure (<5 years), mean (SD)					
PCP	0.37 (0.15)	0.4 (0.15)	0.43 (0.15)	0.45 (0.16)	0.44 (0.15)
Nurse care manager	0.42 (0.14)	0.43 (0.14)	0.49 (0.16)	0.43 (0.14)	0.43 (0.12)
Clinical associate	0.49 (0.15)	0.49 (0.15)	0.57 (0.17)	0.46 (0.13)	0.46 (0.14)
Administrative clerk	0.52 (0.14)	0.54 (0.16)	0.45 (0.16)	0.57 (0.15)	0.58 (0.14)
Support staff/PCP, mean (SD)	2.5 (1.0)	2.9 (1.1)	2.9 (1.1)	3.0 (1.6)	3.1 (1.5)
Facility-level Veteran enrollees, mean (SD)	65,082 (34,720)	64,212 (34,780)	64,811 (35,703)	65,380 (36,544)	65,744 (37,366)
Facility-level Veteran enrollees/PCP, mean (SD)	1,450 (372)	1,438 (373)	1,388 (369)	1,376 (375)	1,340 (383)
Percentage change in enrollees/PCP since previous year, median (IQR)	--	-0.74 (-5.32, 4.49)	-3.84 (-7.65, 0.88)	-1.03 (-4.90, 3.21)	-2.72 (-6.47, 2.38)

*AES= All Employee Survey

†PCP=primary care provider

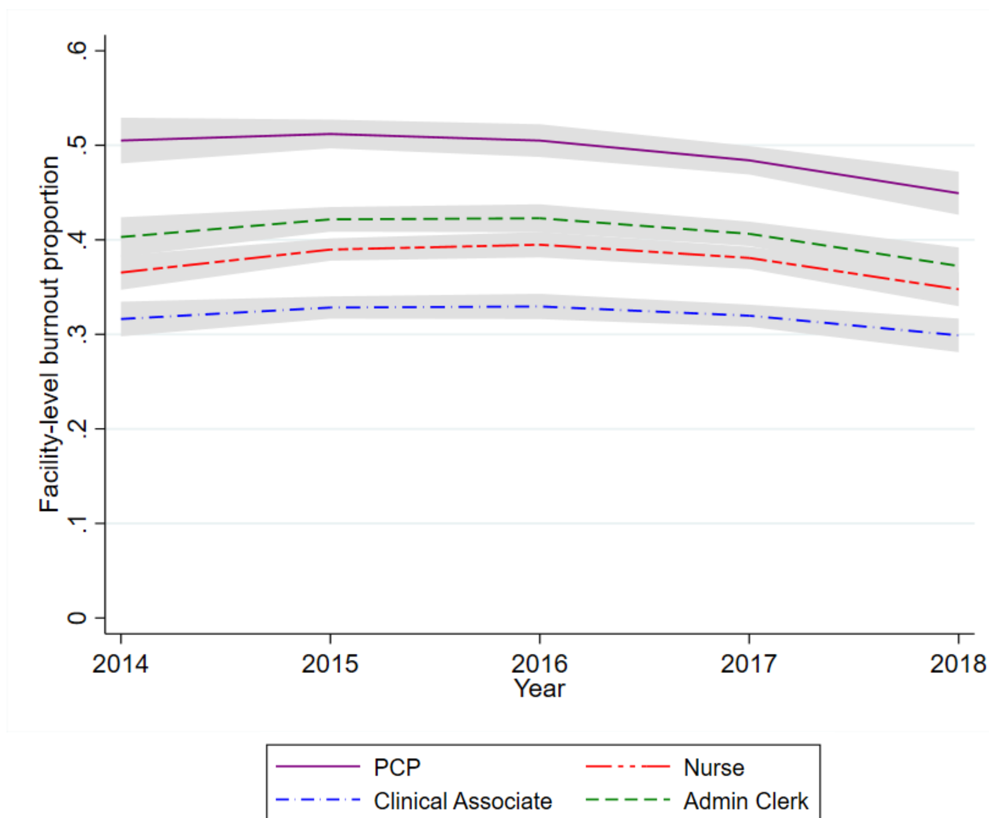

Figure 2.1. **Trends in burnout for VHA facilities from 2014-2018.** Trend lines estimate the mean proportion of employees at VHA facilities who report burnout by year and primary care role with 95 CIs. PCP=primary care provider.

2.3.1 Unadjusted Results

In unadjusted models of the association between enrollment/PCP and burnout, enrollment was significantly associated with burnout among PCPs and administrative clerks (Model group 1, Table 2.2). The proportion of employees reporting burnout at VHA facilities increased by 1.4 percentage points (pp) for PCPs (95% CI: 0.4 to 2.4) and by 1.1 pp for administrative clerks (95% CI: 0.2 to 2.0) for every 100 additional enrollees/PCP at a VHA facility. For example, based on unadjusted mean burnout in 2014 (see Appendix Table 2.A1), adding 100 enrollees/PCP at a facility would predict an increase in burnout from 29.7% to 31.1% for PCPs

and from 24.8% to 25.9% for administrative clerks. Level of enrollment/PCP was not significantly associated with burnout for nurses or clinical associates in unadjusted models.

In unadjusted models of the change in enrollment, burnout among nurses was significantly associated with a year-over-year change in enrollment/PCP (Model group 3, Table 2.3). Burnout increased by 0.2 pp among nurses (95% CI: 0.1 to 0.3) for every 1% change in enrollees/PCP since the previous year. For example, based on unadjusted mean burnout in 2015 (see Appendix Table 2.A2), increased patient enrollment by 1% from 2014 to 2015 at a facility would predict an increase in burnout from 38.0% to 38.2% for nurses. The year-over-year change in enrollment/PCP was not significantly associated with burnout for the other primary care roles in unadjusted models.

Table 2.2. Percentage point (pp) change in facility-level burnout associated with an increase of 100 Veteran enrollees/PCP*

PACT role	Model Group 1: Unadjusted pp change in burnout (95% CI)	Model Group 2: Adjusted pp change in burnout (95% CI)†
Primary Care Provider (PCP)	1.4 (0.4, 2.4)	0.5 (-0.6, 1.6)
Nurse (RN)	-0.1 (-0.7, 0.5)	-0.4 (-1.0, 0.3)
Clinical associate	0.6 (-0.1, 1.2)	0.2 (-0.6, 1.0)
Administrative Clerk	1.1 (0.2, 2.0)	0.5 (-0.3, 1.4)

* PCP=primary care provider

† For each PACT role, fixed effects linear regression models were adjusted for proportions of survey respondents who were female, under 50 years, and had a VHA tenure less than 5 years; number of support staff per PCP; and an indicator for year (ref=2014)

Table 2.3. Percentage point (pp) change in facility-level burnout proportion associated with a 1% year-over-year increase in Veteran enrollees/PCP*

PACT role	Model Group 1: Unadjusted pp change in burnout (95% CI)	Model Group 2: Unadjusted pp change in burnout (95% CI)†
Primary Care Provider (PCP)	0.1 (-0.1, 0.3)	0.1 (-0.1, 0.3)
Nurse (RN)	0.2 (0.1, 0.3)	0.2 (0.1, 0.3)
Clinical associate	0.1 (0.0, 0.2)	0.1 (-0.1, 0.2)
Administrative Clerk	0.1 (-0.1, 0.2)	0.0 (-0.1, 0.2)

* PCP=primary care provider

† For each PACT role, fixed effects linear regression models were adjusted for proportions of survey respondents who were female, under 50 years, and had a VHA tenure less than 5 years; number of support staff per PCP; and an indicator for year (ref=2015)

2.3.2 Adjusted Results

Associations between enrollment and the proportion of burnout at VHA facilities were not statistically significant for any primary care role in adjusted models (Model group 2, Table 2.2). In adjusted models of the year-over-year change in enrollment, nurse burnout remained significantly associated with enrollment change (Model group 4, Table 2.3). A 1% increase in enrollees/PCP since the previous year was associated with a 0.2 pp increase in the proportion of nurses reporting burnout (95% CI: 0.1 to 0.3). Based on adjusted mean burnout in 2015 (see Appendix Table 2.A2), for example, increased patient enrollment by 1% from 2014 to 2015 at a facility would predict an increase in burnout from 48.0% to 48.2% for nurses at facilities with average proportions of nurses who were female, had tenures less than 5 years, and were under 50 years old and with average levels of staff support/PCP.

Also, recall the median year-over-year change in enrollment was a decrease of 2.72% enrollees/PCP from 2017 to 2018 (Table 2.1), for example. Therefore, for a facility experiencing median year-over-year change in enrollment, a 2.72% decrease in enrollment equated to a 0.54pp decrease in nurse burnout in 2018 compared to 2017. Coefficients for the absolute (Appendix

Table 2.A1) and relative (Appendix Table 2.A2) burnout effects in the unadjusted and adjusted models were reported in the appendices.

2.4 DISCUSSION

Our findings indicate that patient enrollment was not a determinant of burnout in VHA primary care, except among nursing staff. Both patient enrollment and burnout varied substantially among VHA facilities over the time frame studied. Yet, we found only a modest association between nurse burnout and year-over-year change in patient enrollment. Otherwise, the size of the enrolled patient population at VHA facilities was not associated with burnout in primary care within the levels observed during this study period.

To our knowledge, this is one of the first studies to assess associations between change in patient-related workload and burnout in multiple primary care occupations.[18]We used a previously validated definition of burnout.[29,42] Compared to previous research, estimated burnout for VHA PCPs in this study was on par with estimates observed elsewhere, which were at or above 50%.[42,43] For VHA RNs in this study, burnout was slightly higher than previous estimates, which were approximately 30%.[43,66,67] While most research on burnout in healthcare focuses on physicians or nurses,[72] we assessed burnout in other primary care occupations, which had notable levels of burnout. We found 30% of clinical associates and upwards of 40% of administrative staff reported burnout. Patient-related workload is shared across primary-care team members, and excess workload may disproportionately affect some primary care team members. Evaluating burnout at the organizational level acknowledges that burnout in health care is a shared problem and aids in identifying aggregate burnout indicators which may be affected through policy or facility-wide interventions.[1]

We relied on a novel measure of workload – VHA patient enrollment – as a potential burnout indicator. Previous VHA research observed a nearly linear relationship between regional growth in patient enrollment and another important organizational outcome, poorer patient-reported access to care.[86] That finding suggested that patient enrollment may stress health systems with potential consequences for health care staff. While patient enrollment is not a perfect proxy for staff workload, its organizational utility in predicting patient health care use drove our interest in using it as a potential burnout predictor.

The limited associations with burnout observed in this study contrast with prior findings on patient-related workload and burnout at the VHA. Previous research observed a strong association between primary-care team panel overcapacity (defined as having a panel greater than 1,200 patients per full-time primary-care team) and team-member burnout.[25] We found a different association, but the effects of patient-related workload may be different at the team level than at the facility level. Still, the positive association between growth in patient enrollment and nurse burnout observed in our study is novel. Prior research suggests that increasing reliance on nurses within primary care teams was associated with nurse burnout.[87] More research is needed on whether nurses bear a disproportionate burden of workload when enrollment grows at VHA facilities. Based on our estimates in the adjusted analyses of relative enrollment change, if the percentage of enrollees/PCP increased by 10%, two more nurses for every 100 nurses employed at that facility would experience burnout. While this is a small effect, nurse burnout could have important consequences when added up to the organizational level, such as from costly turnover and patient satisfaction. A recent study of nurse burnout found that a 10% increase in nurse burnout was associated with up to 1.3% lower ratings of patient satisfaction.[88]

Findings in this study indicate that not all patient-related workload may be associated with burnout. The size of the enrollment ratios observed in this study may also fall within a manageable realm, potentially below a threshold where patient enrollment numbers could be associated with burnout. It is important to note that not all enrollment at the VHA translates into health care utilization. Only about 50% of enrollees use VHA primary care within 6 months since enrollment,[89] and almost 8% of Veterans live far enough from the nearest VHA clinic to be eligible to seek care outside of VHA facilities through Community Care provider networks.[90] Patient assignment to primary care teams may not directly correlate with added workload as some enrollees may use little or no VHA care or in a limited way, such as through pharmacy services.

Notably, as well, patient enrollment may not be equally distributed across primary care teams. The VHA's patient management system distributes patient workload across primary care teams. This may correct for patient-related workload on a team-level basis – a factor which would not be picked up when averaging patient enrollment by facility. Previous research also suggests that, for providers, being female, younger in age, and having shorter work tenure are associated with increased burnout.[2,91] While we adjusted for the proportion of these demographics by facility, future research may find stronger associations when analyzing these characteristics in individual or team level research.

While evidence is inconclusive on the optimal number of patients under a provider's care, including in association with burnout,[92] our finding suggest that patient enrollment is limited in predicting burnout. However, the enrollment to provider ratios observed in this VHA study may be substantially lower than in other health systems. Health systems with high ratios of patients to providers (with estimates upwards of >4,000 patients per PCP in some studies)[92] may observe

different associations. Burnout associations at higher levels of patient enrollment and potential threshold effect of enrollment on burnout could be further explored.

2.4.1 Limitations

Limitations of this research include the timing of the AES compared to estimation of enrollment and non-response bias. The AES is offered in the Spring of each year; however, enrollment measures were only available in September for 2014-2018. Also, survey non-response could be associated with burnout which, in turn, may lead to under-reporting of burnout for VHA personnel. This is particularly true if employees experiencing burnout declined to take the survey. Another limitation was reporting bias, particularly if respondents under or overestimated burnout at the time of survey response compared to their annual average burnout level. Additionally, unmeasured time-varying confounders could include contemporaneous events or factors associated with burnout which systematically varied within facilities over time. These factors could offer alternative explanations for changes in burnout besides patient enrollment.

2.5 CONCLUSION

Identifying organizational-level predictors of burnout can inform policy and intervention opportunities to complement to individual-level interventions; however, accurate identification of burnout predictors is challenging.[6]We did not observe an association between patient enrollment and burnout for primary care staff, except for nurse burnout associated with patient enrollment growth. More longitudinal burnout research on patient-related workload is needed to

improve causal inference, particularly at the team or unit level in team-based practice environments.

2.6 APPENDIX

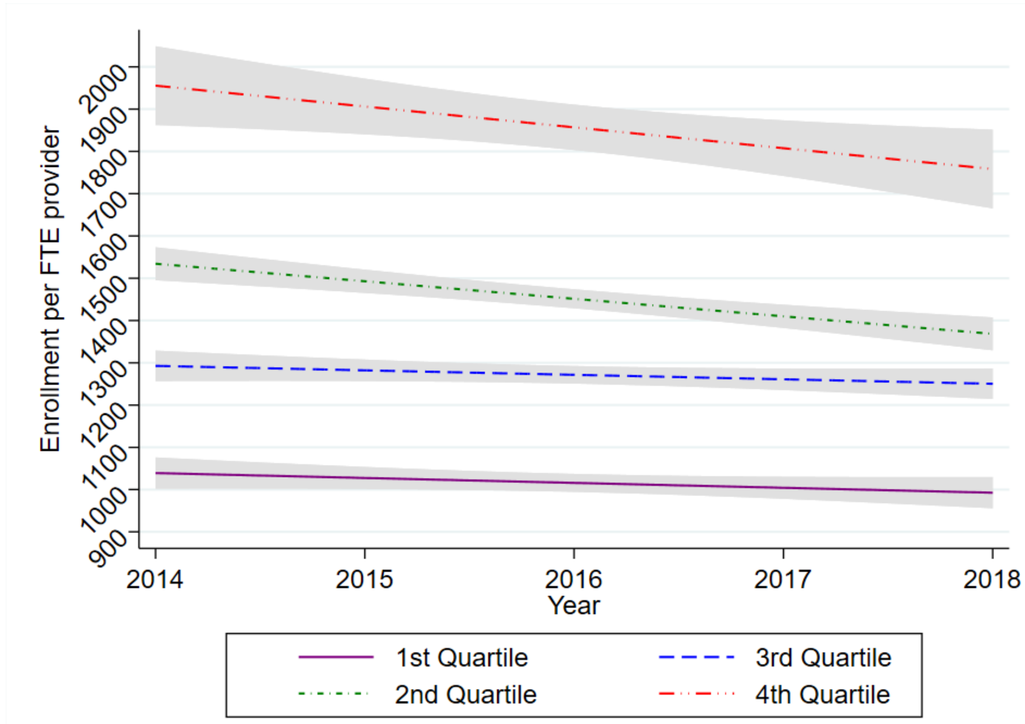

Figure 2.A1. Trends in mean enrollment per full-time equivalent primary care provider (enrollment/PCP) from 2014-2018 by quartile of enrollment/PCP calculated in 2014. VHA facilities were grouped into quartiles by magnitude of their 2014 enrollment/PCP. The first quartile includes VHA facilities with the lowest enrollment ratio, and the fourth quartile includes VHA facilities with the highest enrollment ratios. Trend lines represent the trajectories of mean enrollment/PCP for VHA facilities in each quartile with 95 CIs.

Table 2.A1. Fixed effects linear regression models of enrollment/PCP and burnout at VHA facilities

	Burnout proportion at a facility			
	Unadjusted results (Model 1)		**Adjusted results (Model 2)**	
	Coeff.	95% CI	Coeff.	95% CI
Primary Care Providers (PCP)				
100 enrollees/PCP	0.014	(0.004, 0.024)	0.005	(-0.006, 0.016)
Proportion tenure <5 yrs.			-0.128	(-0.254, -0.003)
Proportion female			0.073	(-0.032, 0.178)
Proportion under 50 yrs.			0.017	(-0.101, 0.135)
Support staff/PCP			-0.002	(-0.021, 0.018)
Year (ref=2014)				
2015			-0.025	(-0.051, 0.001)
2016			-0.015	(-0.044, 0.015)
2017			0.001	(-0.030, 0.032)
2018			-0.073	(-0.107, -0.039)
Intercept	0.297	(0.159, 0.435)	0.455	(0.269, 0.642)
Nurses				
100 enrollees/PCP	-0.001	(-0.007, 0.005)	-0.004	(-0.010, 0.003)
Proportion tenure <5 yrs.			-0.161	(-0.260, -0.062)
Proportion female			-0.008	(-0.151, 0.135)
Proportion under 50 yrs.			0.123	(0.010, 0.237)
Support staff/PCP			-0.006	(-0.016, 0.004)
Year (ref=2014)				
2015			0.004	(-0.019, 0.027)
2016			0.016	(-0.006, 0.038)
2017			0.025	(0.002, 0.047)
2018			-0.037	(-0.061, -0.013)
Intercept	0.42	(0.325, 0.512)	0.460	(0.279, 0.642
Clinical associate				
100 enrollees/PCP	0.006	(-0.001, 0.012)	0.002	(-0.006, 0.010)
Proportion tenure <5 yrs.			-0.148	(-0.257, -0.039)
Proportion female			-0.018	(-0.146, 0.110)
Proportion under 50 yrs.			0.067	(-0.036, 0.171)
Support staff/PCP			-0.009	(-0.018, 0.000)
Year (ref=2014)				
2015			0.004	(-0.186, 0.027)
2016			0.006	(-0.020, 0.031)
2017			0.012	(-0.016, 0.039)
2018			-0.031	(-0.058, -0.004)
Intercept	0.241	(-0.144, 0.338)	0.370	(0.213, 0.528)
Administrative Clerk				
100 enrollees/PCP	0.011	(0.002, 0.020)	0.005	(-0.003, 0.014)
Proportion tenure <5 yrs.			-0.222	(-0.309, -0.135)
Proportion female			0.013	(-0.084, 0.109)
Proportion under 50 yrs.			0.123	(-0.001, 0.247)
Support staff/PCP			-0.008	(-0.025, 0.010)
Year (ref=2014)				
2015			-0.006	(-0.033, 0.021)
2016			0.016	(-0.013, 0.045)
2017			0.019	(-0.012, 0.049)
2018			-0.041	(-0.069, -0.012)
Intercept	0.248	(0.125, 0.372)	0.401	(0.228, 0.574)

Table 2.A2. Fixed effects linear regression models of the year-over-year change in enrollment per FTE PCP and burnout at VHA facilities

	Burnout proportion at a facility			
	Unadjusted results (Model 3)		**Adjusted results (Model 4)**	
	Coeff.	95% CI	Coeff.	95% CI
Primary Care Providers (PCP)				
1% change in enrollees/PCP	0.001	(-0.001, 0.003)	0.001	(-0.001, 0.003)
Proportion tenure <5 yrs.			-0.121	(-0.269, 0.026)
Proportion female			0.028	(-0.095, 0.150)
Proportion under 50 yrs.			-0.036	(-0.16, 0.090)
Support staff/PCP			-0.003	(-0.020, 0.014)
Year (ref=2015)				
2016			0.012	(-0.015, 0.039)
2017			0.022	(-0.009, 0.053)
2018			-0.049	(-0.078, -0.020)
Intercept	0.487	(0.483, 0.491)	0.551	(0.443, 0.659)
Nurses				
1% change in enrollees/PCP	0.002	(0.001, 0.003)	0.002	(0.001, 0.003)
Proportion tenure <5 yrs.			-0.195	(-0.317, -0.073)
Proportion female			-0.051	(-0.204, 0.103)
Proportion under 50 yrs.			0.105	(-0.047, 0.256)
Support staff/PCP			-0.009	(-0.022, 0.003)
Year (ref=2015)				
2016			0.020	(-0.001, 0.040)
2017			0.024	(0.002, 0.046)
2018			-0.033	(-0.056, -0.009)
Intercept	0.380	(0.378, 0.382)	0.480	(0.309, 0.650)
Clinical associate				
1% change in enrollees/PCP	0.001	(0.000, 0.002)	0.001	(-0.001, 0.002)
Proportion tenure <5 yrs.			-0.082	(-0.206, 0.043)
Proportion female			0.031	(-0.132, 0.193)
Proportion under 50 yrs.			0.022	(-0.095, 0.139)
Support staff/PCP			-0.014	(-0.027, -0.002)
Year (ref=2015)				
2016			0.003	(-0.021, 0.026)
2017			0.007	(-0.015, 0.030)
2018			-0.036	(-0.060, -0.012)
Intercept	0.320	(0.317, 0.322)	0.373	(0.227, 0.518)
Administrative Clerk				
1% change in enrollees/PCP	0.001	(-0.001, 0.002)	0.000	(-0.001, 0.002)
Proportion tenure <5 yrs.			-0.188	(-0.299, -0.077)
Proportion female			0.053	(-0.059, 0.165)
Proportion under 50 yrs.			0.081	(-0.049, 0.212)
Support staff/PCP			-0.002	(-0.017, 0.014)
Year (ref=2015)				
2016			0.017	(-0.011, 0.045)
2017			0.018	(-0.010, 0.046)
2018			-0.044	(-0.072, -0.016)
Intercept	0.405	(0.402, 0.407)	0.434	(0.313, 0.554)

Chapter 3. CHANGES IN ELECTRONIC NOTIFICATION VOLUME AND PRIMARY CARE PROVIDER BURNOUT

3.1 INTRODUCTION

Although electronic health records (EHRs) improve data management and communication within health care; they can be a source of stress and job dissatisfaction for healthcare providers.[16,43,51,68,93,94] For primary care providers (PCPs), the EHR inbox is important for communication of test results, referrals, medication refills, and messages;[51] and PCPs spend approximately 1-2 hours or more per day managing asynchronous EHR inbox notifications.[50,95,96] EHR tasks can be time-intensive, inefficient, and compete with direct patient care; they may also spill into personal time and could contribute to burnout.[16,43,97–100]

Burnout – typified by physical, mental, and emotional responses to stressors at work – is common among PCPs, affecting half of physicians in primary care and up to a third of nurse practitioners (NPs) and physician assistants (PAs).[25,42,43,60,101] Optimizing complex and cumbersome EHR systems could potentially improve the working environment for PCPs, who are among the highest users of EHRs, and decreasing the stress and fatigue related to managing inbox notifications might improve PCP well-being;[99] In the Veterans Health Administration (VHA), 87% of PCPs reported that inbox notifications levels were unmanageable, potentially risking patient safety via care delays from missed test result notifications.[102] Though, evidence on inbox notifications and burnout is equivocal. The concurrent measurement of notifications and burnout in recent studies, which is prevalent in burnout studies at-large, also limits inference on the effect of notification volume on burnout.[68,96,103,104] While notifications are notably burdensome, one study found notification process time did not predict burnout in physicians.[96]

Other studies correlated high notification volumes with provider burnout[104] and emotional exhaustion.[103]

It is not clear if reducing inbox notification burden could reduce burnout. In 2017, the VHA launched a nationwide initiative to address unmanageable notification volumes by optimizing notifications received by PCPs (also called "view alerts").[54] During the initiative, each facility formatted its EHR interface to include a mandatory set of notifications based VHA and facility priorities (e.g., critical laboratory values); trained PCPs in EHR customization of optional notifications; and tracked pre-and post-initiative notification levels for samples of PCPs at each facility.[53,54,105] After the initiative, large shifts in daily notification volume were observed within some VHA facilities (i.e., increases or decreases of up to 100 notifications per PCP per day), but not others.[54] Assessing the dose-response relationship between notifications and burnout can help determine if reducing inbox notification volume is sufficient to reduce EHR-related stress. For this study, the initiative served as a natural experiment to test the association between burnout and changes in inbox notification volumes.

3.2 METHODS

3.2.1 Study Design and Setting

In this observational study, we linked estimates of inbox notification volumes before and after the VHA's EHR initiative with serial cross-sectional survey-based estimates of PCP burnout for 138 VHA facilities. The VHA is one of the largest health care systems in the U.S., and each VHA facility is comprised of a local network of a medical center and multiple community clinics. At the time of the inbox notification initiative, the VHA employed the Computerized Patient Record System (CPRS) to manage patient care within the VistA system, the VHA's

integrated EHR. Inbox notifications within CPRS alert staff to clinical workflow tasks, including laboratory and imaging results, medication refills, messages from colleagues and patients, referral follow-up, and signature requests.[53] In some cases, these notifications address potentially critical items needing providers' attention, such as abnormal imaging results. Other notifications are of lower value for providers, such as notification of a patient no-show for an appointment. These notifications may be better handled by someone other than the provider.[54] PCPs manage dozens to hundreds of inbox notifications daily.[50,54] The CPRS inbox allows for user customization, such as through enabling or disabling non-mandatory notifications.[93,106] Mandatory notifications generally require action and were further described by Shah and colleagues.[54]

3.2.2 Data and Study Population

Inbox notification data were collected by VHA operations during the inbox notification initiative and were measured before and after the initiative for a subset of PCPs for each facility. A team at the Michael E. DeBakey Veterans Affairs Medical Center performed an evaluation of the initiative; notification volume data were provided by this study team. While the inbox notification initiative affected providers across specialties, PCPs managed the most inbox notifications [50] and were the focus of the initiative. The initiative resulted in a mean decrease in notifications,[54,107] and approximately 97% of PCPs were trained on EHR inbox optimization.[54]

For the present study, notification data were limited to VHA facilities with primary medical centers located in U.S. states. In the original data, some facilities were split into sub-facilities. In these few instances, notification volumes for the main medical center were

measured independently of other clinics within the facility. These facilities were also omitted since burnout was measured across facilities as a whole. The final sample included 138 facilities.

PCPs burnout was estimated for each VHA facility using aggregated responses to the VHA's annual workforce survey, the All Employee Survey (AES), collected each spring.[78] This anonymous survey assesses employee attitudes and the workplace environment through questions on, for example, job satisfaction, social support, turnover intentions, and burnout. Within each facility, individual AES responses were aggregated for respondents who indicated being a PCP (physicians, NP, or PA) and working in primary care, i.e., a member of a patient-aligned care team (PACT) on the survey. Aggregate responses were reported as proportions, e.g., the proportion of PCPs at a facility who were female or who reported burnout. AES response rates for VHA staff were 57% in 2016, 60% in 2017, and 62% in 2018.[76–78]

Aggregate AES data were combined into a serial cross-sectional data set from 2016-2018 using facility identifiers. Notification volume data were linked to aggregate AES data for 2016 (pre-initiative) and 2018 (post-initiative). The 2017 AES collection overlapped with the inbox notification initiative; so, to ensure a valid exposure timeline, AES data for 2018 was used to estimate post-initiative burnout. The 2017 AES data was used for the description of burnout trends but omitted for inferential analyses. As per data use agreements, we complied with a minimum aggregation requirement of 10 AES respondents for facility-level measures. This resulted in the exclusion of 15.8% of facility-level observations, primarily from smaller VHA facilities. Also, for some facilities, data was only used for either 2016 or 2018 due to the minimum aggregation requirements. The final sample included 6,459 PCP survey respondents aggregated for 138 VHA facilities in 2016 and 2018.

3.2.3 Measures

VHA facilities were categorized into five groups based on their post-initiative change in notification volume. Using the distribution of the percent change in the mean number of inbox notifications per PCP per day for facilities, we differentiated the facility groups with cut points of ±0.25 standard deviation (SD) and ±1 SD away from the mean change in notification volume for all VHA facilities. The five groups comprised facilities with (1) a large decrease (> -1 SD of the distribution of percentage change in notifications), (2) small decrease (-0.25 to -1 SD), (3) no change (-0.25 to +0.25 SD), (4) small increase (+0.25 to +1 SD), and (5) large increase (> +1 SD) in the percent change in notification volume. Facility group was the primary exposure in this study.

The primary outcome was the prevalence of burnout among PCPs at each facility. The AES includes three questions based on each of the three dimensions of burnout characterized within the Maslach Burnout Inventory: [81,82] emotional exhaustion, depersonalization, and reduced achievement. Consistent with previous literature, we constructed a composite measure of burnout from the emotional exhaustion ("I feel burned out from my work") and depersonalization questions ("I worry that this job is hardening me emotionally").[82,84,108] These questions were assessed on a seven-point Likert scale of the frequency of burnout symptoms, ranging from never to every day. We defined burnout as answering, "Once a week," "A few times a week," or "Every day," to the emotional exhaustion and/or the depersonalization questions.[42,84] Burnout was calculated as the proportion of PCP survey respondents at a facility who screened positively for burnout.

Characteristics of the PCP samples at each facility were determined from aggregate AES measures of PCP respondent gender, age, and VHA tenure. Gender (i.e., the proportion PCP

respondents who were female), age (i.e., the proportion PCP respondents less than or greater than 50 years old), and short VHA tenure (i.e., the proportion PCP respondents with a VHA tenure of less than five years) were used as precision variables. Younger age, female gender, and shorter tenure were previously associated with burnout in providers.[2,91]

3.2.4 Statistical Analyses

Characteristics of PCPs in each of the five facility groups were described using AES data for the number, age, gender, and tenure of PCP survey respondents. Inbox notification volume was described for each of the five facility groups pre- and post-initiative. To describe burnout levels pre- and post-initiative, mean PCP burnout proportions were plotted from 2016-2018 for the facility groups.

Fixed effects (FE) linear regression models were used to estimate the effect of the level and direction of changes in inbox notification volume on the proportion of PCP burnout at the facility level. FE models are useful for determining causal estimates with panel data while limiting bias from confounding, and they rely on variability in the exposure over time to estimate the effect of the exposure on an outcome.[109] For this study, the base FE model (Model 1) estimated the effect of the changes in notification volume on PCP burnout for facilities which experienced small and large increases and small and large decreases in notification volume. The base and adjusted models included an indicator for year to assess secular trends in PCP burnout due to unobserved factors over the study period. The adjusted FE model (Model 2) of changes in notification volume and burnout included age, gender, and short tenure as precision variables in addition to the year indicator. A fixed effect for VHA facility accounted for time-invariant confounding, or the bias associated with unobserved heterogeneity between VHA facilities.

Effectively, each facility served as its own control by estimating the burnout-notification volume relationship in comparison with its own pre-initiative PCP burnout prevalence.[110] We used robust standard errors, clustered by facility, in both models. This study was approved by the VA Puget Sound Health Care System and University of Washington Institutional Review Boards. All analyses were performed using Stata software (version 17).[111]

3.3 RESULTS

After the inbox notification initiative, mean daily inbox notifications for VHA facilities reduced from 128 inbox notifications pre-initiative (SD: 52; ranging from 31 to 378) to 114 inbox notifications post-initiative (SD: 44; ranging from 40 to 329). The percent change in daily inbox notifications decreased by a mean of 5.9% (SD: 30.1%) and ranged from a 71% decrease

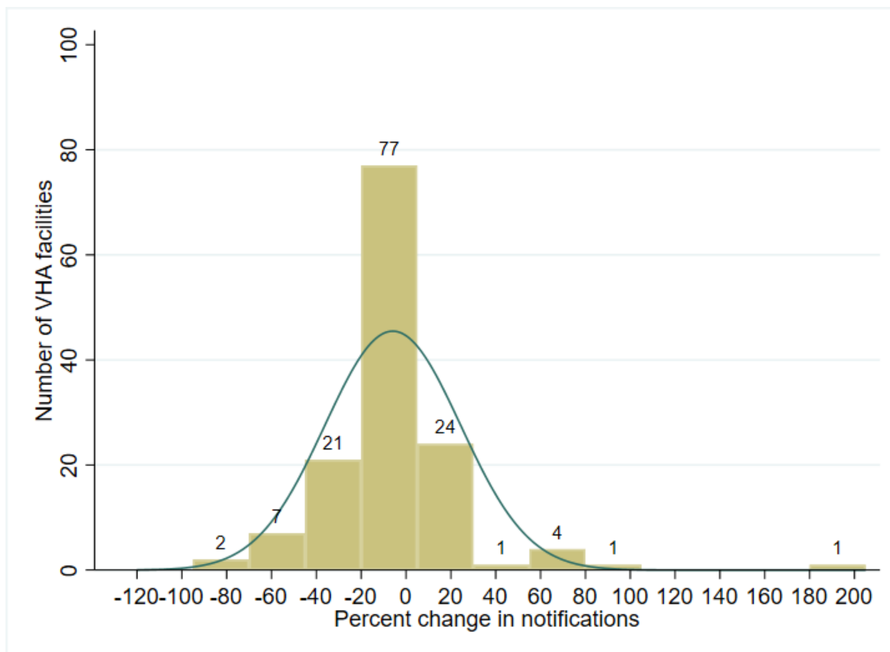

Figure 3.1. Histogram of VHA facilities (n=138) by the percent change in mean daily inbox notifications per primary care provider after the inbox notification initiative. There was a 5.9% mean decrease in daily inbox notifications (SD: 30.1%).

to a 200% increase in notifications (Figure 3.1) for VHA facilities in this study. Based on the distribution of percent change in inbox notifications, ±1 SD equated to a ±30% change in notifications and a ±0.25 SD equated to a ±7% change in notifications.

The five facility groups were distributed as follows (1) large decrease facilities which had a >30% reduction in inbox notifications (14.5% of facilities, n=20); (2) small decrease facilities with a 7-30% reduction in inbox notifications (37.0% of facilities, n=51); (3) no change facilities with a within ±7% change in inbox notifications (reference category, 29.7% of facilities, n=41); (4) small increase facilities with a 7% to 30% increase in inbox notifications (13.8% of facilities, n=19); and (5) large increase facilities with a >30% increase in inbox notifications (5.1% of facilities, n=7).

Table 3.1 describes PCP sample characteristics and inbox notification volume results for these five facility groups. Across the groups, 46% to 56% of PCPs at VHA facilities were female, 35% to 41% were under 50 years of age, and 39% to 44% had VHA tenures shorter than five years. Facilities with a large decrease in inbox notifications (>30%) had both the highest levels of pre-initiative notifications (mean: 159, SD: 69) and the lowest levels of post-initiative notifications (mean: 83, SD: 32). Facilities with large increases in inbox notifications (>30%) had both the lowest levels of pre-initiative notifications (mean: 83, SD: 30) and the highest levels of post-initiative notifications (mean: 142, SD: 40).

From 2016-2018, PCP burnout decreased for all VHA facilities (Figure 3.2). Burnout in facilities that experienced no change in inbox notifications decreased from 51.1% in 2016 to 43.8% in 2018. PCP burnout was initially highest for facilities that increased notifications >30%, at 61.3% (SD: 11.9%), though burnout in these facilities reduced to 46.3% (SD: 14.2%) by 2018.

In both the base and adjusted models (Table 3.2), neither small nor large increases or decreases in notification volume were significantly associated with facility-level PCP burnout. However, PCP burnout decreased significantly over the study period. In 2018, PCP burnout was 7.3 percentage points [95% Confidence Interval (CI): -11.4 to -3.3] lower in the base model compared to 2016 and 6.4 percentage points (95% CI: -10.4 to -2.4) lower in the adjusted model compared to 2016.

Table 3.1. Summary statistics for All Employee Survey respondents and the inbox notification initiative at VHA facilities (n=138)

	Facility Group				
	Facilities with no change in notifications (within ±7%) n=41	Facilities with a reduction of >30% notifications n=20	Facilities with a reduction of >-7% to -30% notifications n=51	Facilities with an increase of >7% to 30% notifications n=19	Facilities with an increase of >30% notifications n=7
All Employee Survey respondents in 2016 (mean, SD)					
Number of PCP[a] respondents per facility	25 (13)	23 (11)	28 (15)	23 (14)	20 (10)
Proportion with short VHA tenure (<5 years)	0.43 (0.16)	0.41 (0.16)	0.44 (0.15)	0.43 (0.14)	0.39 (0.14)
Proportion under 50 years of age	0.41 (0.14)	0.35 (0.12)	0.39 (0.13)	0.35 (0.12)	0.43 (0.12)
Proportion female	0.56 (0.12)	0.51 (0.12)	0.55 (0.13)	0.54 (0.16)	0.46 (0.17)
Inbox notification initiative results (mean, SD)					
Pre-initiative daily inbox notifications[b] (2016)	123 (45)	159 (69)	132 (51)	113 (40)	83 (30)
Post- initiative daily inbox notifications (2018)	122 (44)	83 (32)	111 (44)	130 (44)	142 (40)

[a] PCP=Primary care provider; the inbox notification initiative occurred in 2017.
[b] Daily inbox notifications were estimated as the mean number of inbox notifications per PCP per day.

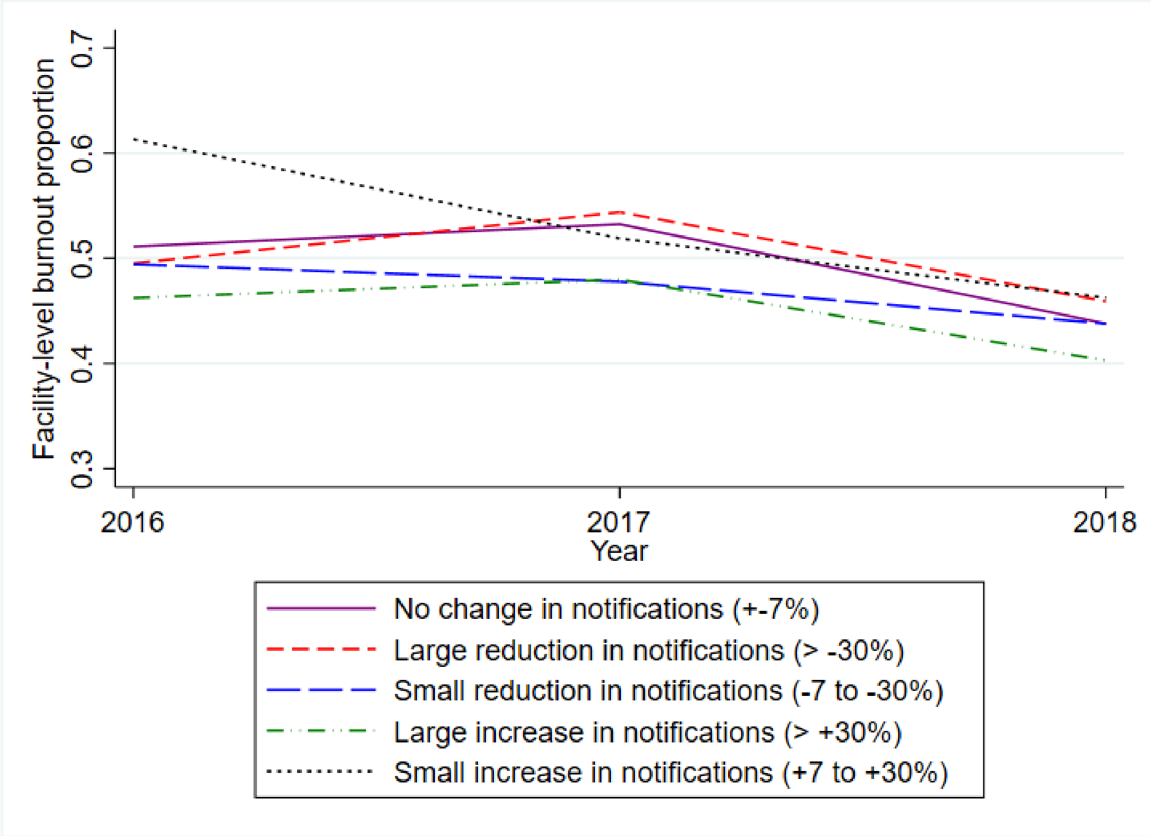

Figure 3.2. Fit plot of primary care provider burnout proportion from 2016-2018 for the five initiative groups of VHA facilities by post-initiative change in inbox notifications.

Table 3.2. Associations between level of change in daily inbox notifications and primary care provider (PCP) burnout proportion at VHA facilities

	Model 1: Base Model		**Model 2:** Adjusted Model	
	Coefficient[a]	(95% CI[b])	Coefficient[a]	(95% CI)
Facility group by percent change in notification volume				
Reduction (>-30% notifications)	0.041	(-0.053, 0.135)	0.036	(-0.057, 0.129)
Reduction (>-7% to -30% notifications)	0.018	(-0.041, 0.078)	0.011	(-0.045, 0.069)
Increase (>7% to 30% notifications)	0.016	(-0.076, 0.109)	-0.004	(-0.102, 0.094)
Increase (>30% notifications)	-0.051	(-0.159, 0.058)	-0.072	(-0.168, 0.024)
Year				
2016 (ref)	--		--	
2018	-0.073	(-0.114, -0.033)	-0.064	(-0.104, -0.024)
Short tenure of <5 years[c]	--		-0.092	(-0.333, 0.150)
Age under 50[d]	--		-0.184	(-0.446, 0.079)
Female[e]	--		0.035	(-0.172, 0.242)
Constant	0.500	(0.486, 0.514)	0.592	(0.419, 0.765)

[a] Coefficient represents the change in proportion of PCPs reporting burnout at a VHA facility.
[b] CI=Confidence Interval
[c] Proportion of PCPs with a VHA tenure of less than five years. Coefficient estimate is the effect of having short tenure compared to a tenure of greater than five years on PCP burnout.
[d] Proportion of PCPs under 50 years of age. Coefficient estimate is the effect of being under 50 years of age compared to over 50 years of age on PCP burnout.
[e] Proportion of PCPs who were female. Coefficient estimate is the effect of female gender compared to male gender on PCP burnout.

3.4 DISCUSSION

A VHA-wide initiative to improve its EHR-based inbox notification system resulted in large changes in inbox notification volume at VHA facilities. Yet, neither increases nor decreases in notification volumes were associated with PCP burnout. To our knowledge, this is the first study to go beyond cross-sectional associations and test burnout in response to a change in EHR notification volume in primary care. While previous findings on notification-related work burden and burnout are mixed,[96,103,104] our finding suggests that reducing inbox notification volume was not sufficient to have a measurable effect on burnout.

Notifications volumes observed in this study were comparable to previous estimates at the VHA.[50,54] While the inbox notification initiative focused on reducing burdensome EHR messages, inbox optimization did not always result in a reduction in notification volume. Almost 20% of facilities in this study increased their notification volume post-initiative. While compliance with the initiative was high across VHA facilities, notification volumes varied widely between facilities, even with the initiative's mandatory notification guidelines and PCP training.[54] The multi-site nature of this study demonstrates the wide range in notification volumes that PCPs may experience depending on personal and organizational preferences. Also, some VHA facilities had already made substantive improvements to their inbox systems reducing notifications prior to the initiative. These facilities may have increased their notification volumes because they were required to comply with the initiative.[54]

While our findings contrast recent research relating message volume to increased PCP burnout,[103,104] these prior studies relied on concurrent cross-sectional measurement of message volume and burnout. By assessing change in notification volume within facilities, we controlled for confounding and questions of temporality, which are problematic in cross-sectional research. Our findings support the position that there may not be an optimal number of notifications to minimize PCP burnout, at least at the levels observed in this study.

The VHA-wide inbox notification initiative was not specifically directed at reducing burnout, but it was developed in recognition that EHR-related workload is a central facet of PCP work life. Patient and job-specific needs may dictate inbox optimization by PCPs. One prior study of missed test results in EHRs found that notification volume was limited in predicting information overload.[102] Another study identified numerous aspects of EHRs which may be

associated with burnout, including excessive data entry and slow system response time.[94] Optimizing how and when notifications are displayed is important the user's experience.

In this study, we did not differentiate between notification types. Despite contributing to notification volume, some types of notifications likely contributed little to notification-related workload while others contributed more. For example, the initiative emphasized reducing duplicative notifications and notifications that required reading time but not additional PCP actions. These particular notifications may not have been time intensive. Also, the number of mandatory notifications reduced by up to one third for some facilities.[54] Some decrease in notifications may be attributed to turning off lower-value notifications that PCPs spent little time on or had previously ignored outright. Notification volume alone may be a poor measure of the actual effort required for inbox management. While substantial increases and decreases in notification volume may reflect improved EHR utilization, changes in notification volume may not have influenced aspects of EHR-related workload which are predictive of burnout.[49] Assessment of notification type, value, and cognitive burden may improve measures of EHR notification burden, which may then be associated with burnout. Further work is needed to understand how time spent on low-value notifications and sufficient work time to respond to notifications can influence PCP fatigue and burnout.[100]

Health systems are uniquely positioned to mitigate burdensome aspects of EHRs through improved EHR systems design.[104] Ensuring EHR notifications are relevant and actionable, rather than purely informational;[51] continually monitoring utilization patterns to identify low-value notifications or the efficacy of new and automated notifications;[104,112] innovating the design and visual display of notification systems; and ensuring users can quickly navigate through EHR interfaces may all enhance EHR operability.[105,112] PCPs spend more time on inbox messaging

than clinicians in other medical or surgical specialties,[113] and interventions reducing EHR work burden should consider PCP's specific needs. Collaboration between health system leaders and PCPs on EHR design, with a focus on staff well-being, is essential.[1,104]

3.4.1 Limitations

This study relied on annual surveillance of burnout among VHA PCPs. To reduce overlap between the AES collection and inbox notification initiative implementation, we used 2018 rather than 2017 burnout estimates post-initiative. Notification levels at facilities may have changed in the time between the initiative and the 2018 AES collection, or the effect of the initiative may have waned in the interceding time. Survey response bias is also a concern and could lead to under-reporting of burnout (e.g., if PCPs experiencing higher burnout declined survey participation) and potential underestimation of burnout. Also, staffing information on full-time equivalency of PCPs, or the number of PCP contributing to the mean measurement of daily notifications, was not available. This could affect accuracy of inbox notification measurement.

The VHA uses a unique EHR, and notification volume estimates used in this study were VHA specific. We categorized facilities into five facility groups based on the distribution of post-initiative percent change in notifications, though burnout was potentially affected by changes in notification levels for other reasons besides the initiative. Facilities where inbox notification counts increased may have conducted previous EHR efficiency work. Also, unmeasured factors influencing PCP burnout occurring simultaneously at the VHA, like other EHR improvements, could confound the relationship between notification volume changes and

burnout. Lastly, the group of facilities which increased notifications >30% was small (n=7) and potentially underpowered.

3.5 CONCLUSION

Asynchronous inbox notifications can be time consuming and burdensome for PCPs. We hypothesized that decreasing inbox notifications would reduce PCP burnout; however, we did not observe any effect on burnout even though the VHA’s initiative resulted in substantial decreases in notifications in some facilities but not others. Other characteristics of inbox notifications that we did not measure may be important. Future research on burnout needs to evaluate characteristics such as notification type and value, and time spent managing notifications, especially through use of causal study designs. As EHR systems evolve, health systems should work with PCPs to identify effective and efficient solutions that improve EHR use and support staff well-being.

Chapter 4. FULL PRACTICE AUTHORITY AND BURNOUT AMONG PRIMARY CARE NURSE PRACTITIONERS

4.1 INTRODUCTION

Full practice authority (FPA) environments authorize nurse practitioners (NPs) to evaluate patients, prescribe medications, and manage treatments as independent providers.[55] In contrast to FPA, restricted practice authority is defined by career-long physician supervision requirements in one or more domains of practice, such as through physician collaboration agreements, prescribing oversight, and limited hospital privileges.[55,114] Reduced practice is typically characterized as career-long physician collaboration requirements for prescribing authority, particularly for controlled substances.[55,114] FPA, in comparison, allows NPs maximum autonomy to treat and prescribe at the top level of their education and training.[56] Prior research finds that FPA is associated with higher job satisfaction and retention among NPs;[61,115–117] and FPA may be advantageous for addressing another critical health care workforce issue—burnout.

Burnout is an occupational condition characterized by mental, emotional, and physical response to stressors at work, and in the healthcare work environment, burnout is often the product of excessive demands.[1,8,118] An estimated one-quarter to one-third of NPs report job-related burnout.[60,119,120] The job demands-resources (JD-R) model of occupational well-being – a common framework for burnout – describes how job resources balance with job demands to influencing burnout.[5] The JD-R theory conceptualizes job demands as stress-inducing and job resources as stress-reducing aspects of work.[5,64] Professional autonomy – the flexibility to use one's skills and resources independently – is generally viewed as a resource for employees which may counter job demands and be protective against burnout.[5] For most NPs, aspects of their

professional autonomy are specified within practice authority regulations. These practice regulations are typically defined by nurse practice acts at the state level. While professional autonomy may vary by individual NP, changes to practice authority regulations affect autonomy for the NP workforce at large. Increased autonomy which comes with FPA may act as a stress-reducing job resource for NPs; yet little is known about NP burnout in relation to FPA regulations.[117]

In the U.S., some states grant FPA to NPs, while practice authority is reduced or restricted for NPs in other states.[55] One recent study found that independent NP practice, measured within a sub-scale of organizational climate, was correlated with a lower odds of NP burnout.[60] However, that study was limited to two states and relied on cross-sectional measures, which are susceptible to confounding.[60] In other health care professions, autonomy has also been found to correlate with lower burnout, though primarily through cross-sectional research.[5,27] To our knowledge, there are no previous studies on the effect of changes in NP practice regulations on NP burnout. To address this gap, we assessed the effect of changing from reduced or restricted practice authority to FPA on burnout among NPs employed in primary care.

In 2017, the Veterans Health Administration (VHA) implemented a federal regulation authorizing FPA for all NPs employed within the VHA. The VHA's Advance Practice Registered Nurse (APRN) FPA regulation designated all VHA NPs as licensed independent practitioners.[121] This regulation superseded state NP practice laws and regulations, except for controlled substance prescribing which falls under the Federal Controlled Substances Act.[122] As federal employees, NPs may hold licensure in any state and practice within the VHA despite the location (or state) of the facility. The regulation addressed the confusion created by VHA NPs operating side-by-side under disparate state-level practice regulations and fostered consistency in

care delivery for Veterans treated by NPs. Using the VHA's regulatory change, we tested the effect of a large-scale policy change in NP practice authority on burnout among the VHA's NP primary care workforce.

While the APRN FPA regulation was not implemented to address burnout directly, this regulation offers an opportunity to test whether health facilities changing to FPA observed a change in burnout among NPs. We predicted that the autonomy provided by FPA would correlate with lower burnout. The VHA, one of the largest integrated health systems in the U.S., has an organizational commitment improve workforce well-being,[63] and policy changes like this regulatory change may affect workers, such as through burnout, in unexpected ways. Findings on burnout associated with a change to FPA may be of interest to VHA administration and the clinical workforce, particularly as an unintended consequence of a policy change. They could also be informative on NP well-being for other health systems or stakeholders within states undergoing practice authority rule changes. Additionally, burnout levels within a health system may serve as a metric of organizational health,[1] and this study considers a potential burnout predictor for the NP workforce when a health system-wide change is made at the organizational level.

4.2 METHODS

4.2.1 Study Design and Setting

In this quasi-experimental study, we linked facility-level estimates of burnout among NPs working in primary care at the VHA to the practice authority regulations covering the facilities where they worked. The VHA serves over 9 million Veterans who are enrolled in care at medical facilities nationwide.[123] Each VHA facility is comprised of a medical center and a network of

community-based outpatient clinics. Some states like Alaska and Hawaii have one facility, while other more populous states have multiple facilities. VHA facilities may also cover multiple states, with community-based outpatient clinics located in neighboring states to where the central medical center is located.

Prior to passage of the APRN FPA regulation, VHA facilities followed state NP practice regulations. VHA NPs practiced under the license which they held, regardless of their state of employment.[124] In 2016, 22 states and the District of Columbia licensed NPs with FPA,[125] while other states regulated reduced or restricted practice authority (Appendix Figure 4.A1). After the regulation was enacted in 2017, most VHA facilities authorized FPA for NPs. While the regulation applied to all VHA NPs, this analysis was limited to burnout among NPs in primary care, the setting in which most NPs are employed.[126]

4.2.2 Data Sources

The units of analysis in this study were VHA facilities. We used state laws and NP scope of practice regulations in 2016[125] to determine whether each VHA facility changed from reduced or restricted practice authority to FPA or remained FPA throughout the study. Facilities were coded with a binary indicator for whether they were in reduced or restricted practice authority states or FPA states in 2016, prior to enactment of the regulation. Reduced and restricted practice authority facilities were grouped together since their states' laws and regulations restricted at least one aspect of NP practice authority. Previous research observed little distinction between reduced and restricted practice on determinants of day-to-day autonomy for NPs.[57] All facilities were classified as FPA after the federal regulation in 2108.

Practice authority data was then linked to burnout estimates for VHA facilities. Facility-level estimates of burnout among NPs were calculated by aggregating responses to questions on burnout from the All Employee Survey, the VHA's annual workforce survey. The All Employee Survey is an anonymous survey which the VHA uses to identify organizational strengths and needs based on employee perceptions.[127] The survey assesses workplace climate, employee attitudes like job satisfaction, and other outcomes like turnover intention and burnout. Burnout was estimated as the proportion of primary care NP respondents reporting burnout at a facility in a year. Demographic and occupational questions are also included.

For this study, individual survey responses were aggregated to the facility level for each year in the study (i.e., facility-year measures). To assess burnout before and after the APRN FPA regulation, aggregate survey responses for the 2016 and 2018 survey years were linked into a serial cross-sectional data set using facility identifier. The All Employee Survey is offered each spring, so the 2017 survey year was excluded due to the short period between the 2017 All Employee Survey dissemination and implementation of the VHA's full practice authority regulation in January 2017. Survey response rates for all VHA employees was 57% in 2016 and 62% in 2018.[77,78] NP specific response rates to the All Employee Survey were not available to the study team.

4.2.3 Facility Sample

The initial sample for this study included 138 VHA facilities with medical centers located in U.S. states. Preliminary exclusion criteria excluded three VHA facilities in Arizona and Minnesota which did not grant NPs FPA by 2016, despite Arizona and Minnesota allowing FPA by this time. Twelve additional facilities were excluded due to inconsistency in state-level NP

practice regulations within a multi-state facility (e.g., when a facility's medical center was in an FPA state, but the facility had outpatient clinics in reduced or restricted practice authority states). One hundred twenty-three VHA facilities remained after this preliminary exclusion criteria.

To improve accuracy of aggregate measurements and reduce the variability inherent in using a single observation of a dichotomous outcome (e.g., facility-level burnout proportion), a minimum of three survey responses on the burnout measure per facility from primary care NPs were required for aggregation of All Employee Survey measures. Thus, some facilities provided information for only one of the two survey years, or not at all. For aggregation of survey measures, we selected survey respondents who self-identified on the survey as being an NP and a member of a primary care team, also called a Patient-Aligned Care Team (PACT) within the VHA.[128] Based on the minimum aggregation requirement, 27% of the remaining 123 facilities were excluded in 2016 (n=33), and 20% of facilities were excluded in 2018 (n=25). The final sample included survey responses aggregated for 610 NPs at 90 facilities in 2016 and 742 NPs at 98 facilities in 2018.

4.2.4 Burnout Outcome

In the All Employee Survey, burnout was measured using three questions based on the Maslach Burnout Inventory (MBI):[81] emotional exhaustion, depersonalization, and reduced achievement. Each question was answered using a Likert scale of frequency of symptoms: never, a few times a year of less, once a month or less, a few times a month, once a week, a few times a week, or every day. Burnout dimensions defined in the MBI are commonly used in burnout research,[129] and using more than one dimension of burnout to accurately assess burnout is recommended.[130,131] Following previous studies, we dichotomized burnout as yes or no for each

survey respondent.[29,42] Respondents screened positive for burnout by answering once a week or more often on the emotional exhaustion ("I feel burned out from my work") and/or the depersonalization ("I worry that this job is hardening me emotionally") questions. Individual responses were aggregated for each facility, and facility-level burnout was calculated as the proportion of NPs at a facility who screened positive for burnout.

4.2.5 Covariates

Three aggregate All Employee Survey variables were used to describe gender, age, and tenure characteristics of the NP populations at VHA facilities. Responses were aggregated at the facility level as the proportion of NP respondents who were female, the proportion of NP respondents less than 50 years old, and the proportion of NP respondents with short tenure at the VHA (i.e., a VHA tenure of less than 5 years). In prior research, these three covariates were associated with burnout in NPs and physicians.[2,91] We included them to improve the precision of parameter estimates for burnout.

4.2.6 Statistical Analyses

Facilities included in the final sample were described before and after the FPA regulation in 2016 and 2018, respectively. Defining facilities based on their 2016 practice authority categories, NP burnout was plotted for reduced or restricted and FPA facilities pre- and post-regulation. Linear regression models were used to perform a difference-in-differences (DID) analysis estimating the effect of a change from reduced or restricted to FPA on NP burnout. DID analyses are often used to estimate the effect of policies on health outcomes,[132] particularly in research settings where experimental techniques are infeasible. DID models measure the

comparative change in an outcome, like burnout, over time by between a treatment group (e.g., VHA facilities which changed from reduced or restricted to FPA due to a policy) relative to a comparison group (e.g., VHA facilities which regulated FPA prior to the policy change).[110] In this study, the comparison group of FPA facilities provided a counterfactual trajectory in NP burnout for reduced or restricted practice facilities as would be expected in the absence of the regulation change. Our DID linear regression models estimated the difference in pre-post changes in burnout between the treatment and control groups. This accounted for secular trends in burnout over time across all facilities.

The base regression model, Model 1, included an indicator for practice authority designation (reduced or restricted practice versus FPA), an indicator for pre- or post-regulation (i.e., year), and a term for their interaction. This interaction term estimated the DID effect of changing from reduced or restricted to full practice authority on the proportion of NP burnout at VHA facilities. In Model 2, the adjusted regression model, we included the terms described in the base model and added facility-level indicators for gender, age, and tenure of NPs at VHA facilities. Heteroskedastic robust standard errors, accounting for the clustering of observations by facility, were estimated. Marginal means and 95% confidence intervals (CIs) of burnout proportions and DID estimates were calculated for both models. The VA Puget Sound and University of Washington Institutional Review Boards approved this study. All analyses were performed using Stata software (version 17).[111]

4.3 RESULTS

The facility sample is described in Table 4.1. For the study sample, 77% of VHA facilities in 2016 (n=69 out of 90 facilities) and 77% of facilities in 2018 (n=75 out of 98

facilities) were in states with reduced or restricted practice authority for NPs at the start of the study. The remaining 23% of VHA facilities included from 2016 (n=21) and 23% of facilities included from 2018 (n=23) were in states with FPA for NPs prior to the VHA regulation. In 2016, 610 NPs completed the All Employee Survey, with a mean of 7 respondents per facility [Standard Deviation (SD): 4]. In 2016, mean proportions of 0.84 (SD: 0.16) NPs were female; 0.35 (SD: 0.26) were under 50 years old; and 0.45 (SD: 0.25) had VHA tenures shorter than 5 years. In 2018, after enactment of the FPA regulation, 742 NPs completed the All Employee Survey, with a mean of 8 respondents per facility (SD: 4). In 2018, mean proportions of 0.83 (SD: 0.16) NPs were female; 0.42 (SD: 0.23) were under 50 years old; and 0.44 (SD: 0.23) had VHA tenures shorter than 5 years.

Table 4.1. Characteristics of Veterans Health Administration (VHA) facilities

	Before the VHA FPA* regulation (2016) n=90**	**After the VHA FPA regulation (2018)** n=98**
Facility sample		
Facilities in reduced or restricted practice states in 2016, n (%)	69 (77)	75 (77)
Facilities in FPA states, n (%)	21 (23)	23 (77)
All Employee Survey respondents		
Total primary care nurse practitioner (NP) respondents	610	742
NP respondents at a facility, mean (SD)	7 (4)	8 (4)
Facility-level proportion of NP respondents who were female, mean (SD)	0.84 (0.16)	0.83 (0.16)
Facility-level proportion of NP respondents under 50 years of age, mean (SD)	0.35 (0.26)	0.42 (0.23)
Facility-level proportion of NP respondents with short VHA tenure (<5 years), mean (SD)	0.46 (0.25)	0.44 (0.23)

* FPA = Full practice authority; ** Inclusion criteria for facilities in each survey year required that there were at least 3 NP respondents to the burnout measure per facility.

Figure 4.1 illustrates the decrease in unadjusted facility-level burnout proportions among reduced or restricted practice and FPA facilities pre- to post-regulation. For facilities that operated in states with reduced or restricted practice, unadjusted burnout estimates decreased from 0.47 (95% CI [0.41, 0.53]) before the VHA regulation granted FPA to 0.35 (95% CI [0.30, 0.40]) after the VHA regulation (Model 1, Table 4.2). For facilities that operated in states that already granted FPA before the VHA regulation, burnout decreased from 0.50 (95% CI [0.38, 0.63]) before the VHA regulation to 0.43 (95% CI [0.34, 0.53]) after the VHA regulation.

Adjusted estimates of burnout proportions and the difference-in-difference results are presented in Table 4.2 for the adjusted regression analyses (Model 2). Adjusted burnout estimates were similar to the unadjusted estimates. For facilities that operated in states with reduced or restricted practice for NPs, unadjusted burnout estimates decreased from 0.47 (95% CI [0.41, 0.53]) before the VHA regulation to 0.34 (95% CI [0.29, 0.39]) after the VHA regulation. For facilities that operated in states that already granted FPA before the VHA regulation, burnout decreased from 0.50 (95% CI [0.38, 0.63]) before the VHA regulation to 0.44 (95% CI [0.34, 0.54]) after the VHA regulation. The adjusted pre-post change in the NP burnout proportion was 6 points lower (DID coefficient=0.06*,* 95% CI [-0.22, 0.9]) among facilities which changed from reduced or restricted practice to FPA compared to facilities already subject to FPA; however, this effect was not significant. The regression coefficients were reported in Appendix Table 4.A1 for both models.

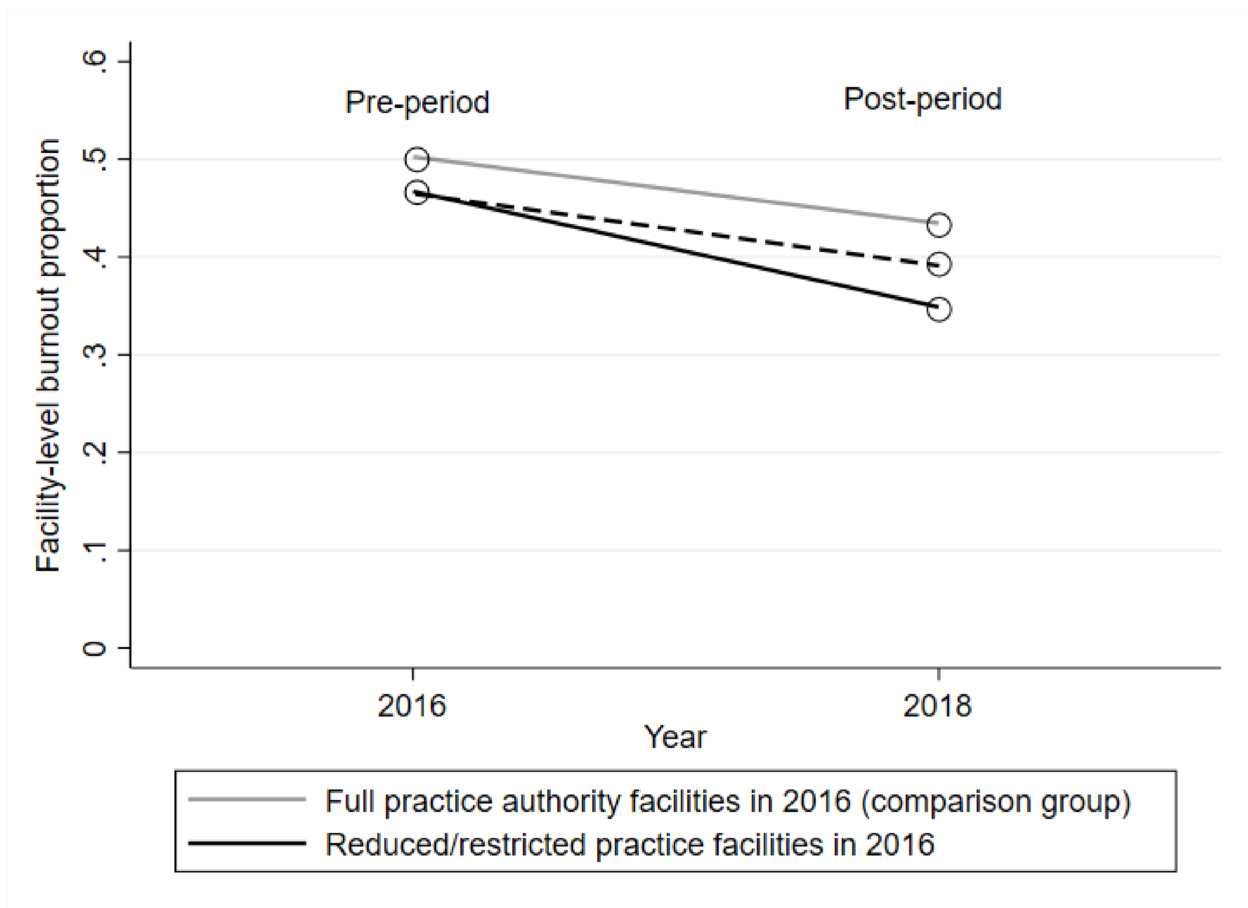

Figure 4.1. Comparison of nurse practitioner (NP) burnout between facilities with reduced or restricted NP practice authority compared to facilities with full practice authority (FPA) for NPs before and after the Veterans Health Administration NP FPA regulation. The dotted line represents the hypothetical change in NP burnout if reduced or restricted practice facilities where not granted FPA.

Table 4.2. Difference-in-differences estimates of the effect of full practice authority on nurse practitioner (NP) burnout at the Veterans Health Administration (VHA)

Group	Before the VHA full practice authority regulation (2016)	After the VHA full practice authority regulation (2018)	Difference from 2016 to 2018
	Burnout proportion (95% CI)	Burnout proportion (95% CI)	Difference in burnout proportion (95% CI)
Base Model (Model 1)			
Reduced or restricted facilities (treatment group)	0.47 (0.41, 0.53)	0.35 (0.30, 0.40)	-0.12 (-0.18, -0.05)
Full practice facilities (comparison group)	0.50 (0.38, 0.63)	0.43 (0.34, 0.53)	-0.07 (-0.21, 0.07)
Difference between Restricted and full Practice	-0.04 (-0.17, 0.10)	-0.09 (-0.19, 0.02)	**-0.05 (-0.20, 0.10)**
Adjusted Model (Model 2)*			
Reduced or restricted facilities (treatment group)	0.47 (0.41, 0.53)	0.34 (0.29, 0.39)	-0.13 (-0.20, -0.06)
Full practice facilities (comparison group)	0.50 (0.38, 0.63)	0.44 (0.34, 0.54)	-0.06 (-021, 0.08)
Difference between Restricted and full Practice	-0.03 (-0.17, 0.10)	-0.10 (-0.21, 0.01)	**-0.06 (-0.22, 0.09)**

Note: Bolded estimate is the difference-in-difference estimate of the effect of authorizing full practice authority on NP burnout.

* Model adjusted for proportion of NP survey respondents who were <50 years of age, female, and had a VHA tenure <5 years

4.4 DISCUSSION

After implementation of the VHA's FPA regulation, NPs employed at VHA facilities in reduced or restricted NP practice environments gained FPA privileges. In this study, we did not observe a significant association between a change in practice authority and the prevalence of burnout among NPs at the VHA. Though, the absolute difference in burnout between facilities which changed to FPA and those previously with FPA was a 6% decline in burnout. While not

significant, this difference is large, and further research is needed to assess the extent to which gaining FPA affects NP burnout.

This study was unique in several important ways. Firstly, to our knowledge, this is the first study to assess a change in burnout in response to a change in NP practice authority in a national sample of NPs using a multi-year data. FPA regulations are driven by many factors, including improved access to care and alleviating primary care provider (PCP) shortages, particularly in rural areas where PCP shortages are pronounced.[59,133–135] Studies of FPA often evaluate these health care access outcomes along with NP job satisfaction; few studies specifically assess FPA's relation to burnout.[60,61,135–137] Though, our findings do correspond to a prior study which observed a significant association between independent NP practice and lower NP burnout.[60]

Findings in this study, however, may be specific to the VHA setting. The VHA offered a unique opportunity to assess NP burnout after a national change in FPA. Most new FPA regulations occur state-by-state, but implementation of the APRN FPA regulation resulted in a FPA for the entire VHA NP workforce. The VHA, like other health systems, is challenged with staffing PCPs. NPs are a critical provider workforce within primary care, and approximately 70% of NPs are employed in primary care practice nationwide.[126,136] FPA can improve health care access issues for patients[59] but it also benefits NPs, such as by reducing NP turnover – a costly consequence for health systems.[117] Future studies, though potentially smaller in scope than this study, could implement study designs which follow NPs longitudinally, as we did, but improve upon measurement of the burnout outcome.

The absence of a statistically significant association between VHA's NP practice regulation and burnout observed in this study may be influenced by several factors. To create a

serial cross-sectional sample from the available data, we aggregated individual-level burnout measures to the facility level. We also dichotomized burnout. In addition to having small numbers of NP respondents at each facility, these approaches could affect the precision of burnout estimates and our ability to detect a significant association. Though, the absolute difference in burnout we observed suggests the need for continued research on FPA and NP burnout. More longitudinal studies are needed. Assessing burnout longitudinally at the individual NP or team level over time may strengthen the correlation between changes in practice authority and burnout.

The prevalence of NP burnout in this study was higher than previously observed. Upwards of 50% of NPs at FPA facilities prior to the regulation reported burnout. This was greater than the one-quarter to one-third of NPs with burnout observed in non-VA settings [60,119,120]. The overall decline in NP burnout at VHA facilities from before to after the regulation suggests that other factors influential to NP burnout occurred during the study, or the methods used to assess burnout in this study were not sensitive enough to pick up a significant association with a change to FPA.

Variation in how the new regulation was implemented across VHA facilities and between NPs and their physician colleagues must also be considered. Through the regulation, all VHA facilities were encouraged to implement FPA for NPs, though this was not mandated until 2019. While we excluded facilities which did not license NPs as independent providers, other facilities in our final sample, or individual providers, may not have changed their practice patterns to reflect the new regulation despite the facility's intention. While practice authority policies set clear boundaries on practice requirements, individual autonomy likely varies among NPs. For example, a study of VHA advanced practice nurses found that autonomy increased with tenure at

the VHA.[115] While we adjusted for tenure at a facility as a whole, there are almost certainly other factors we did not adjust for that influence NP autonomy and likely introduced bias. Though this study evaluated the effect of a broad policy change, future research may consider this variability in practice when assessing associations between professional autonomy and burnout for NPs. Longer follow-up in measuring burnout may also be considered. We estimated burnout one year after the regulation change, though, the effect of changing to FPA on burnout may vary over time.

In the U.S., NP practice authority is trending towards more independence for NP practice. Adjustments to NP professional autonomy are characteristic of these policy changes, though practice policies are not the sole determinant of NP autonomy. In-depth qualitative study of the experience of NPs about their autonomy before and after a change in practice authority may elucidate how and when NP autonomy changes. NPs practice authority changes may also affect burnout in other clinical staff, but little is known about this. Additionally, practice authority changes affect physicians and other clinical staff, patients, and health systems in addition to NPs. While there may be few other opportunities to observe a nationwide change in FPA policy, studying burnout changes within individual NPs before and after changes to state practice regulations may be informative for these other stakeholders.

4.4.1 Limitations

A primary limitation in this study was data aggregation. Surveys were anonymous, so to create the serial cross-sectional data set, data from individual respondents were aggregated to the facility level. Consequently, individual-level information was lost. This may contribute to why we failed to find a significant change, though the absolute decline in burnout was notable. There

was also potential for misclassification of practice authority designation for survey respondents. Practice authority may have differed between the state of licensure for an NP and at the NP's employing facilities. Survey responses were aggregated by facility, so some NPs at each facility were likely practicing under licensure from other states. Responses from these NPs may be misclassified. Additionally, we did not directly measure individual NP autonomy pre- and post-regulation. Instead, we assumed that NPs in reduced or restricted practice facilities gained all aspects of FPA with respect to physician, rather than maintaining the constraints of previous working relationships.

The All Employee Survey is a voluntary survey which could lead to selection bias in survey response. We do not know NP survey response rate by facility, and non-response from NPs experiencing greater burnout could underestimate burnout prevalence. Though, previous research assessed the effect of survey non-response on facility-level burnout prevalence in VHA and failed to find any bias.[138] Finally, our analytic approach assumed that there were no other VHA-wide changes influencing NP burnout besides the regulation under evaluation. Our approach also presumed that pre-intervention burnout trends were comparable between NPs in reduced or restricted and full practice authority states.

4.5 CONCLUSION

NP practice policies affect professional autonomy for NPs, which may be associated with NP burnout. The VHA-wide change to FPA for NPs did not significantly reduce burnout when measured at the facility level, though research at the individual level is needed. Findings in this study add to a broader body of research supporting the contention that FPA for NPs has many advantages for NPs, patients, and health systems with few disadvantages. Correlations between

changes in NP practice policies and an important occupational outcome, burnout, deserve continued investigation for both short and long-term burnout outcomes and in other health care settings.

4.6 APPENDIX

Figure 4.A1. Map of nurse practitioner practice authority by state in 2016. Most VHA facilities followed state practice authority regulations prior to the VHA APRN FPA regulation in 2017.

Table 4.A1. Regression estimates of the proportion of burnout among nurse practitioner (NP) at Veterans Health Administration facilities

	Unadjusted model		**Adjusted model**	
	Coefficient	(95% CI)	Coefficient	(95% CI)
Post-period (2018 vs. 2016)	-0.07	(-0.21, 0.07)	-0.06	(-0.21, 0.08)
Intervention (Restricted practice vs. full practice)	-0.04	(-0.17, 0.10)	-0.03	(-0.17, 0.10)
Proportion tenure <5 yrs.	--		-0.15	(-0.33, 0.03)
Proportion female	--		-0.15	(-0.37, 0.06)
Proportion under 50 yrs.	--		0.04	(-0.13, 0.21)
Post-period * Intervention (DID estimate)	-0.05	(-0.20, 0.10)	-0.06	(-0.22, 0.09)
Constant	0.50	(0.38, 0.63)	0.68	(0.44, 0.92)

Chapter 5. CONCLUSIONS

5.1 SUMMARY OF FINDINGS

In this research, longitudinal measurements of burnout in a variety of primary care roles at the VHA were used to test associations with large-scale, health system-wide changes in Veteran patient enrollment level, EHR notifications, and NP practice authority regulations. We aggregated survey-based burnout estimates for each VHA facility and defined each exposure at the facility level. Findings on associations between changes in these three exposures and subsequent burnout were limited when analyzed at the facility level. Only burnout among nurses was significantly associated with a year-over-year change in Veteran patient enrollment.

In the study of changes in patient enrollment, we assessed whether the absolute volume of patient enrollment and year-over-year change in patient enrollment were associated with burnout in multiple primary care roles. Ongoing regional shifts in where Veterans seek care within the VHA system informed our hypothesis that greater patient enrollment was associated with greater burnout. Through longitudinal assessment, we tested for associations between burnout and patient enrollment volume; no significant associations were found. However, when patient enrollment grew year-over-year, nurse burnout increased. We did not observe significant associations for physicians, clinical associates, and administrative clerks with respect to year-over-year change. Burnout for most clinical roles may not correlate with patient enrollment at the VHA, at the levels observed in this study. The association between patient enrollment growth and nurse burnout deserves further exploration. Health systems experiencing patient population growth may anticipated potential increases in burnout among nurses.

EHR-related tasks are burdensome for PCPs; yet, to date, few studies have investigated the association between EHR-related notification volume and PCP burnout. The VHA's inbox

notification initiative, which was premised on improving inbox efficiency, measured substantial variation in EHR notification volume among PCPs. An overall decrease in notifications after the initiative was observed.[54] We used facility-level changes in mean notification volumes observed during the initiative to test the association between notification volume and PCP burnout. While prior research associates EHR-related work with burnout, we did not find an association between notification volume and PCP burnout. Our findings indicate that notification volume alone may not predict burnout. Researchers and health facilities developing EHR systems may consider multiple aspects of EHR inbox design, such as notification value, type, and process time, in addition to volume, in the effort to reduce burnout.

Prior to the VHA Advance Practice Registered Nurse (APRN) full practice authority (FPA) regulation NP practice authority was regulated at the state level. In 2017, all VHA NPs gained FPA, allowing them to practice as licensed independent practitioners. We assessed NP burnout in facilities which changed from reduced or restricted practice authority to FPA compared to burnout in facilities with FPA prior to the regulation. FPA fosters greater professional autonomy, and autonomy is a job resource associated with reduced burnout. We hypothesized that burnout would reduce with FPA. In our findings, we observed comparatively lower burnout for NPs who gained FPA; however, the effect was not statistically significant. There is limited research on burnout associated with changes in practice authority. Conducting this research in a national sample at the VHA was advantageous for assessing an FPA policy change on a national scale. With restrictions reducing on NP practice and FPA regulations becoming increasingly prevalent state-by-state for NPs, more research on the effect of FPA regulations on burnout is needed, particularly since the effects may vary by practice setting.

5.2 IMPLICATIONS OF THIS RESEARCH

Findings on organizational-level burnout predictors in this research were limited and inconsistent with the expectation that burnout could be improved through organizational change. While these studies had limitations, they were predicated on testing substantial changes in each of the exposures with longitudinal measures of burnout among large samples of primary care workers. Much of the current burnout literature is cross-sectional limiting causal inference between predictors and burnout. When we tested changes over time using a serial cross-sectional data set, we found few signals that burnout was associated with large scale changes in the work environment. While cross-sectional research is valuable for hypothesis generation, more longitudinal burnout research is needed to further substantiate recognized burnout predictors. Also needed are longitudinal studies testing organizational-level burnout predictors which measure burnout at the individual or team level over time.

Our three studies illuminated some of the challenges of performing organizational-level research, and several study design choices may have influenced our findings. First, we relied on aggregated data. Survey data was aggregated for facilities to build serial cross-sectional data sets. Since we could not link individual survey respondents over time due to lack of identifiers, we aggregated respondents to the facility level – the most minimal level we were able to link over time using facility identifiers. Also, we were required to aggregate data to comply with confidentiality concerns when reporting from the All Employee Survey (AES). As a result, information provided by individual survey responses was lost through data aggregation,[139] and the precision of facility-level estimates was likely affected.

Future research conducted using similar exposures may consider assessing burnout longitudinally at the individual or team level. This may require different approaches to

measuring burnout in a cohort of workers besides relying on employee surveys, particularly employee surveys that cannot be linked for individual respondents over time. Additionally, while all three aims controlled for gender, age, and tenure, which previous research associated with burnout in primary care occupations, we used aggregated proportions of these characteristics by facility, e.g., the proportion of survey respondents who were female. Adjusting for these characteristics at the individual level is preferable to controlling for these variables in an aggregate manner. Since we relied on aggregate survey data, we could only control for these variables using aggregated respondent demographic data, which likely limited the precision of these control variables.

Aggregate measures also influenced interpretation of our findings. Associations with burnout predictors may be different for an aggregated group versus in individual-level analyses. Care should be taken to not generalize these findings for the individual worker, thereby committing the ecological fallacy.[139] While a strength of these studies was assessing changes in potential burnout predictors over time, future research on these predictors which measures burnout longitudinally at the individual or team level may find different associations. Individual or team-level findings could also clarify what predicts burnout for workers themselves rather than the worker population. Though, health systems may find value in both interpretations for purposes of planning and resource allocation.

In these studies, we relied on administrative, employee survey, and existing intervention data to test our hypotheses. Conducting research using these resources was likely lower cost than developing and implementing an intervention to test specific burnout predictors; however, this came with limitations. This research may not have captured the most appropriate time periods between measurements of the exposure (e.g., the FPA regulation change) and when the employee

survey assessed burnout (i.e., spring or summer of each year). Use of annual measures and limited selection of time frames for exposures and burnout outcome measurements potentially increased measurement bias. Appropriate time periods for best detecting effects of an organizational change on burnout are not well established, so identifying ideal follow-up times, or extending the follow-up period beyond one year's time, may strengthen future findings.

Another important consideration for interpreting the implications of this research is that the organizational changes assessed in these studies were not targeted at burnout. Our studies were conducted using a natural experiment approach to assess VHA-wide changes made for reasons besides the explicit goal of affecting burnout. Prospective research evaluating burnout in primary care may also help researchers understand what precedes burnout. Future research could be planned in accordance with a work policy or system change, and pointedly measuring burnout could strengthen the validity of findings between organizational changes or interventions and burnout.

Our conclusions from this research also assumed there were limited effects from confounding. Aims 1 and 2 used fixed effect regression modeling to control for time-invariant confounders between facilities. This approach managed confounding due to differences between facilities (e.g., size of facility). However, time-varying confounding may still have caused bias. For example, if an individual facility changed working conditions to prevent burnout during the study, this could affect its burnout trend compared to other VHA facilities. In our analyses, we assumed this was not the case and that the only factors affecting burnout were our predictor of interest and covariates. Aim 3 used a difference-in-differences approach which also relied on the common shocks assumptions to protect against confounding. Like in the need to account for time-varying confounding, we assumed that any organizational-level changes (or shocks)

affecting burnout would have happened simultaneously, and to the same extent, at all VHA facilities. However, it is possible that workplace conditions affecting burnout varied across VHA facilities during our study period, potentially biasing our findings.

Another possible explanation for our limited findings is that as job demands increased (e.g., increased patient enrollment), facilities made other changes to manage these job demands (e.g., adding staffing resources to manage increased Veteran enrollment), which preempted effects on burnout. Like the need to control for time-varying confounding, it can be challenging to assess for preemptive efforts to prevent the outcome of interest – burnout. Qualitative information on simultaneous burnout interventions or other workplace changes which may influence burnout could help with planning analysis and inform analytic interpretation of findings. Also, information on trends in burnout in health care at large adds context to findings. While these studies were conducted prior to the COVID-19 outbreak in 2020, future research may consider large shocks to the health care work environment like was seen during the first years of the COVID-19 pandemic.

Finally, large intervention effects may not be expected based on singular changes in organizational-level burnout predictors. Burnout may be better understood as a function of multiple factors influencing job demands and resources for workers. Our studies isolated potential burnout predictors and tested them individually. However, burnout may not respond – or respond substantially – to a singular policy or work practice change, particularly when burnout is measured in an aggregate way. Though, incremental changes in burnout based on isolated predictors could accumulate from many changes to make progress towards reducing burnout in health care. This research found limited associations between organizational-level

changes in workplace factors and burnout, though lessons learned from this research may strengthen future research opportunities assessing burnout over time among primary care staff.

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