

Variance in Clinical Reminder volume across Veteran Health Administration facilities and association with primary care burnout: a cross-sectional study

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Submitted to: Journal of Medical Internet Research
on: October 17, 2025

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Variance in Clinical Reminder volume across Veteran Health Administration facilities and association with primary care burnout: a cross-sectional study

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Abstract

Background: Clinical decision support tools are deployed to help clinicians follow guideline-based care however, there is concern that these tools can cause burnout, particularly in primary care. The Veteran Health Administration (VHA) uses clinical reminders (CRs), non-interruptive electronic decision support tools, to improve ambulatory care. Evidence is lacking as to whether the volume of decision support alerts across different institutions is associated with facility-wide changes in burnout.

Objective: The primary objective is to compare patient demographics and facility characteristics between low, medium, and high CR burden facilities. The secondary objective is to study the nationwide association of CR volume with primary care staff burnout at VHA facilities.

Methods: A national survey was sent to 134 VHA facilities in 2022 to quantify CR burden at each facility. Staff burnout and VHA facility information was obtained from the VHA Corporate Data Warehouse. We studied the association of CR burden with primary care staff burnout using multivariable and logistic regression models, controlling for facility characteristics.

Results: 100% of VHA facilities responded to the survey. There was substantial facility variation in the number of CRs from 5 at the lowest facility to 254 at the highest. There were no significant differences in patient or facility characteristics between low, middle, and high CR facilities. Despite the high variation in CR volume, there was no significant association between the number of facility CRs and primary care staff burnout.

Conclusions: We found no association between CR burden and burnout, suggesting that health systems should broaden focus beyond alert volume when addressing clinical staff burnout.

(JMIR Preprints 17/10/2025:85147)

DOI: <https://doi.org/10.2196/preprints.85147>

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Title page:

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Text word count: 2116, Figures: 3, Tables: 1, Supplement Figure: 1, References: 31, Abstract word length: 241

Abstract

Background:

Clinical decision support tools are deployed to help clinicians follow guideline-based care however, there is concern that these tools can cause burnout, particularly in primary care. The Veteran Health Administration (VHA) uses clinical reminders (CRs), non-interruptive electronic decision support tools, to improve ambulatory care. Evidence is lacking as to whether the volume of decision support

alerts across different institutions is associated with facility-wide changes in burnout.

Objectives:

The primary objective is to compare patient demographics and facility characteristics between low, medium, and high CR burden facilities. The secondary objective is to study the nationwide association of CR volume with primary care staff burnout at VHA facilities.

Methods:

A national survey was sent to 134 VHA facilities in 2022 to quantify CR burden at each facility. Staff burnout and VHA facility information was obtained from the VHA Corporate Data Warehouse. We studied the association of CR burden with primary care staff burnout using multivariable and logistic regression models, controlling for facility characteristics.

Results:

100% of VHA facilities responded to the survey. There was substantial facility variation in the number of CRs from 5 at the lowest facility to 254 at the highest. There were no significant differences in patient or facility characteristics between low, middle, and high CR facilities. Despite the high variation in CR volume, there was no significant association between the number of facility CRs and primary care staff burnout.

Conclusions:

We found no association between CR burden and burnout, suggesting that health systems should broaden focus beyond alert volume when addressing clinical staff burnout.

Keywords: electronic health record, burnout, decision support, primary care, veterans

Main Text:

INTRODUCTION:

Health systems almost universally deploy electronic health record (EHR) alerts to promote health screening and chronic disease management[1]. The Veterans Health Administration (VHA) uses Clinical Reminders (CRs), patient-specific alerts, to improve outpatient care. Nearly all CRs are expected to be completed by primary care providers (PCPs) and completion rates are often part of PCP performance reviews[2]. Prior evaluations of specific CRs have shown improvements in adherence to chronic disease management and preventive screening guidelines[3, 4]. However, other CRs showed no benefit on clinical quality[5], consistent with prior meta-analyses for computer clinical decision support[6-8]. CR completion rates vary due to inconsistent alert applicability and lack of integration into clinical workflows[2, 9-12]. These design limitations have led to concern about CRs and EHR decision support broadly as contributors of burnout[13, 14], prompting

initiatives to reduce alert burden such as the VHA National Clinical Reminders Workgroup established in 2017[15, 16]. In 2023, responding to concerns about PCP burnout, VHA Chiefs of Staff (COS) performed a nationwide survey with primary care leadership at each facility. 98% of respondents noted CR burden had increased recently and felt this growth contributed to burnout among PCPs and primary care staff. Following this survey, recommendations were made to pause introduction of any new CRs until primary care staff feedback was received and to re-evaluate all CRs annually.

While all facilities using VHA's legacy EHR employ CRs to provide decision support, CR implementation varies between facilities. In addition to nationally standardized CRs, facilities can develop local CRs, leading to substantial variation in CR burden across sites. A prior VHA study found that CR presence ranged from 5% to 100% across 15 common ambulatory conditions among different VHA sites[17]. This study, which surveyed clinical and operational leaders, found that facilities with higher perceived utility and ease of use for CRs tended to have higher volume of CRs, which may suggest that facility and staff features, rather than patient factors such as disease prevalence, drive local CR development. However, it is unknown how this variation in CR burden across sites may impact staff burnout.

In this study, we address this knowledge gap by quantifying the number of active CRs at all VHA facilities nationwide and studying whether the overall number of CRs at a facility is associated with staff burnout. We also sought to evaluate facility characteristics that may explain facility-level CR burden. This study represents the first effort at a national scale to associate alert volume with measures of primary care staff burnout.

MATERIALS AND METHODS:

Overview:

We performed a cross-sectional study using 2022-2023 VHA national data, combining

administration of a national survey on CR volume with existing VA national data capturing facility characteristics, patient demographics, and staff burnout.

VHA Survey on Clinical Reminders:

In 2022, VHA administered a mandatory national survey on CRs to all VHA facilities as part of a review to eliminate unnecessary clinical reminders. A request was circulated to all 134 VHA facilities to submit a list of all clinical reminders. We defined clinical reminder burden as the number of local clinical reminders. We categorized facilities into 3 groups based on percentile in the number of CRs: low (<25), middle (25-75), and high (>75).

Facility-Level Outcomes:

Burnout:

We obtained data from the VA Corporate Data Warehouse (CDW) on primary care staff burnout. Primary care staff included providers, registered nurses, licensed professional nurses, nursing assistants, or other clinical or administrative employees part of a Patient Aligned Care Team (PACT), the primary care team model at VHA. Burnout is derived from the 2022 All Employee Survey (AES) and is the combination of single-item Maslach Burnout Inventory statements about emotional exhaustion and/or depersonalization experienced once a week or more. This method has previously been validated for physicians against the 22-item Maslach Burnout Inventory to correlate appropriately with the core features of emotional exhaustion, depersonalization, and lack of personal accomplishment[18, 19].

Covariates:

Next, the CDW was used to obtain characteristics on each VA facility including the number of primary care patients and providers, patient Gagne comorbidity index, age, and race/ethnicity

(Hispanic, Non-Hispanic Black, Non-Hispanic White, Other), and facility complexity (low, middle, high) which is based on the type of services a facility provides, education and research programs, and patient factors including volume and level of disease burden [20, 21]. The presence of a Chief Health Informatics officer at each facility was obtained from another mandatory survey across VHA facilities.

Statistical Analysis:

Descriptive statistics were calculated to evaluate differences in patient demographics and facility-level characteristics between low, middle, and high-burden facilities. We used Kruskal-Wallis rank sum test for continuous variables and Pearson's Chi-squared test for categorical variables to test the association of CR burden with each patient and facility-level covariate.

Unadjusted analyses were then conducted to test the association of CRs and burnout. Tests involving categorical CRs used Pearson's Chi-squared tests while tests using continuous CRs reported Pearson's correlation coefficient and p-value from a t-test.

In our adjusted models, we used each facility as the unit of analysis. Models therefore used the proportion of staff experiencing burnout as the outcome and patient characteristics of mean age, mean Gagne score, and proportion of non-Hispanic White patients at the facility level. We then performed ordinary least squares multivariable regression to measure the association between CR facility burden and burnout, adjusting for patient characteristics, the presence/absence of a facility Chief Health Informatics Officer, the number of providers and patients, and facility type.

Predicted probabilities for each level of CR categorization were calculated for each outcome. P-values for the model coefficient of the highest CR categorization in each model were reported where the reference level was the lowest CR categorization.

Sensitivity analyses were conducted where the number of CRs was treated as a continuous variable instead of a categorical variable.

All analyses were performed in R version 4.4.0. This study was completed as part of ongoing quality improvement effort and conducted under the authority of the VHA Office of Primary Care. Because it was not considered research per VHA policy, it was not subject to institutional review board review or waiver.

RESULTS:

All VHA facilities nationwide (N=134) completed the survey (100% response rate). The distribution of CRs across each facility ranged from 5 to 254 (Figure 1). At low CR burden sites (n=34), the average was 19 CRs (SD: 5) and median was 20 (IQR: 6.75), middle burden sites (n=67) had 40 CRs (SD: 10) and median was 39 (IQR: 18.50), and high burden sites (n=33) the average was 90 (SD: 39) and median was 79 (IQR: 21).

We compared patient demographics and facility characteristics at low, middle, and high CR burden facilities (Table 1). Average patient age was 60 years (SD: 17) in low burden facilities, 63 years (SD: 17) in medium burden facilities, and 62 years (SD:17) in high burden facilities with standardized mean difference of -0.11 between groups. Gagne score which reflects patient comorbidities did not differ significantly between low (0.33), medium (0.40), and high (0.38) burden facilities with standardized mean difference of -0.04. Patient race/ethnicity also did not differ significantly between low, middle and high burden facilities. There was no clear association between presence of facility complexity, which describes the level of clinical services, research and education programs, and patient volume and disease prevalence at a facility, and being in a higher CR burden facility.

Table 1:

Comparing facilities with low, middle and high burden of CRs

Characteristic*	Low Burden (0-25 CRs)	Middle Burden (25-75 CRs)	High Burden (75 – 254 CRs)	Standardized Mean Difference**
<i>Patient Characteristics</i>				
Total patients (n)	1,867,834	2,329,366	1,492,608	
Age, mean (SD), (years)	60 (17)	63 (17)	62 (17)	-0.11
Gagne Score, mean (SD)	0.33 (1.23)	0.40 (1.33)	0.38 (1.30)	-0.04
Race/Ethnicity				0.12
Non-Hispanic White, n (%)	1,117,837 (61%)	1,674,124 (74%)	953,922 (66%)	
Non-Hispanic Black, n (%)	437,554 (24%)	327,954 (14%)	293,114 (20%)	
Hispanic, n (%)	182,123 (10%)	177,074 (7.8%)	123,084 (8.5%)	
Other, n (%)	82,787 (4.5%)	85,724 (3.8%)	80,998 (5.6%)	
<i>Facility Characteristics</i>				
Facilities (n)	32	67	32	
Clinical reminders, mean (SD)	19 (5)	40 (10)	90 (39)	-2.6
Primary care providers, mean (SD)	63 (36)	42 (20)	56 (25)	0.23
Patients, mean (SD)	51,606 (30,395)	31,720 (15,939)	41,149 (24,320)	0.38
Facility complexity				0.72
High	22 (69%)	37 (55%)	23 (72%)	
Medium	4 (13%)	14 (21%)	2 (6%)	

Low	6 (19%)	15 (22%)	7 (22%)	
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*All continuous variables are mean (SD), all categorical are number (%)

**Cohen's D; Standardized Mean Difference between high and low groups

Numbers may not add to totals and percentages to 100% due to missing data

Next, at the facility level, the number of CRs was compared to rates of primary care staff burnout. Burnout data was available for 102,023 primary care team members across all VHA facilities. Low CR sites averaged 38% staff burnout, middle CR sites had 40% burnout, and high CR sites had 39% burnout. In unadjusted correlations (Figure 2) and adjusted models, no significant association was seen between CR burden at a facility and facility-level primary care staff burnout.

DISCUSSION:

PRINCIPAL FINDINGS:

In this cross-sectional, national survey across the VHA, we found substantial variability in facility-level CRs. There were no differences in patient demographics and facility complexity between low, middle, and high CR facilities to explain why certain facilities had higher CR burden. However, even with high variation across facilities, there was no significant association between facility-level CR burden and primary care staff burnout. Our findings offer new insights on the role of alert burden from VHA clinical reminders, a nationally deployed clinical decision support tool, on primary care staff burnout.

Technology-related burden, particularly from electronic health record (EHR) alerts, is frequently cited as a significant contributor to clinician burnout, especially in primary care[22-24]. Qualitative evidence and single-institution studies suggest that high alert volume may worsen burnout by distracting providers and disrupting workflow[13]. Yet, the relationship between EHR alert volume and burnout remains poorly defined. In the VHA, clinical reminders are a prominent focus of

operational and research efforts due to their extensive use in ambulatory care, leading to recent initiatives to reduce their frequency. 98% of VHA primary care leadership felt CRs were increasing in volume and contributing to burnout in a recent operational survey. However, provider interaction with CRs is shaped by a range of contextual factors, including individual workload and perceived fit of CRs within clinical workflows, making the connection between the volume of alert burden from CRs and burnout unclear[9, 24].

Our study finds a wide range of active CRs across VHA facilities nationwide. A prior national survey of CRs was completed in May 2003 during a national EHR review meeting with data from 104 facilities (76% of active VHA facilities at that time) to study the association between CR burden and facility factors [17]. In our assessment, two decades later, with 100% response rate across 134 VHA facilities, we replicate the high variance in CR volume previously described and find greater than 50-fold difference in CR volume between the facility with the lowest CR volume (5) and highest (254). Similar to prior work, we find no explanation from facility characteristics such as size or services offered that explain this high variation. Next, we extended the prior work by comparing facilities across patient factors including age and comorbidity scores. Facilities that take care of more complex patients might be expected to create more decision support tools to support their staff. However, we did not find any differences in patient demographics or comorbidity scores between low, medium, and high CR burden facilities, leaving differences in CR burden unexplained. Site factors including availability of clinical informaticians, resources dedicated to EHR maintenance and improvement, or culture around clinical decision support may explain some of this variance. These cultural factors should be studied in future work, but are difficult to quantify in survey-based assessments[25, 26].

Unlike the prior VHA CR study, we also investigate the association between CR burden and burnout. To our knowledge, this is the first study to examine the connection between alert burden from decision support and burnout through variability in use of a single platform across more than 130 hospitals. Our results conflict with a prior study that found a positive association between subjective

experience of alert burden and burnout [13]. However, there are multiple reasons our results may differ. CRs are asynchronous, patient-specific and rule-based alerts. Non-interruptive alerts avoid mandatory disruptions, contrasting sharply with interruptive alerts, which are overridden at rates as high as 96%[27]. As a result, CRs may not disrupt primary care workflow, a key driver of EHR-related dissatisfaction[28, 29]. Instead, CRs may fulfill the intended purpose of reducing cognitive load on staff by helping nudge towards evidence-based practices, mitigating against burnout[30]. Additionally, factors unrelated to EHR alert burden, such as staffing ratios, clinician autonomy, and compensation, may influence burnout more particularly among non-physician staff who have experienced recent increases in burnout[31-33]. While EHR inbox alerts are another commonly mentioned factor contributing to burnout, a prior nationwide VHA study found that a reduction in EHR inbox notifications did not meaningfully change PCP burnout[34], underscoring the challenge in linking EHR optimization efforts to burnout reduction. Future work across health systems should aim to rigorously quantify alert usage patterns including time spent engaging with CRs to determine objective association with burnout.

LIMITATIONS:

Our study has several limitations. First, we measured CR availability rather than actual utilization. Additional work is needed to measure clinical use of CRs. Nevertheless, prior work and internal VA survey results provide support that the number of alerted CRs might be associated with differences in burnout. Second, counting CRs alone may not fully capture alert burden, as reminder design influences user workload. Time-motion studies, for example, show that completion time for VA alerts varies widely—from 15 to over 150 seconds[35]. Characterizing time burden and cognitive load to process CRs will help more accurately capture provider workload. Third, our survey items may not fully capture burnout. That said, we utilized previously validated items, which are also utilized internally by VA as indicators of burnout. Finally, the cross-sectional nature of our study limits causal

inference.

CONCLUSIONS:

In summary, we present the first national assessment of clinical reminders, a non-interruptive decision support tool used extensively in VHA ambulatory care settings and contribute to the broader literature on EHR alerts through a multi-facility analysis of a single alert platform utilized by more than 130 VA hospitals. We find significant local variability in clinical reminder volume that did not reflect underlying patient or facility differences. Our findings may challenge the common assumption that reducing alert volume alone will diminish burnout. Instead, the design and function of a specific alert type must be considered. In ambulatory settings, non-interruptive alerts may offer an appropriate balance of influencing behavior and avoiding workflow disruption, since alerts are less time-sensitive compared to inpatient clinical deterioration warnings. Ultimately, we underscore the need for ongoing research into specific EHR features, ideally through multi-site studies that can isolate the impact of individual design elements.

Acknowledgements:

No use of generative artificial intelligence was used for this manuscript.

Funding:

This work was undertaken as part of the VA Primary Care Analytics Team. This research includes data obtained from the Veterans Health Administration Office of Performance Measurement (17API2), which resides within the Office of Analytics and Performance Integration under the Office of Quality and Patient Safety. This project was funded by the US VA Health Services Research and Development Quality Enhancement Research Initiative (QUE 20-018).

The funder had no role in the design and conduct of the study; collection, management, analysis, and

interpretation of the data; preparation, review, or approval of the manuscript; and decision to submit the manuscript for publication.

Data availability:

The de-identified datasets generated or analyzed during this study may be available on reasonable request based on Veterans Health Administration approval.

Prior presentations: This work was presented at the AMIA Symposium in San Francisco, CA in November 2024.

Abbreviations:

CR – Clinical Reminder

EHR – Electronic Health Record

VHA – Veterans Health Administration

Disclaimer: The views expressed are those of the authors and do not necessarily reflect the position or policy of the VA or the US government.

Conflicts of interests: Dr. Reddy reported receiving grants from the Department of Veterans Affairs (VA) during the conduct of the study. Dr. Rosland reported receiving grants from the VA during the study and salary from the VA Healthcare System outside the submitted work. Dr Chang reported serving as a consultant for Behavioral Health Services Inc. outside the submitted work. No other disclosures were reported.

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Human Ethics and Consent to Participate declarations: Because it was not considered research per VHA policy, it was not subject to institutional review board review or waiver.

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Figures:

Figure 1:

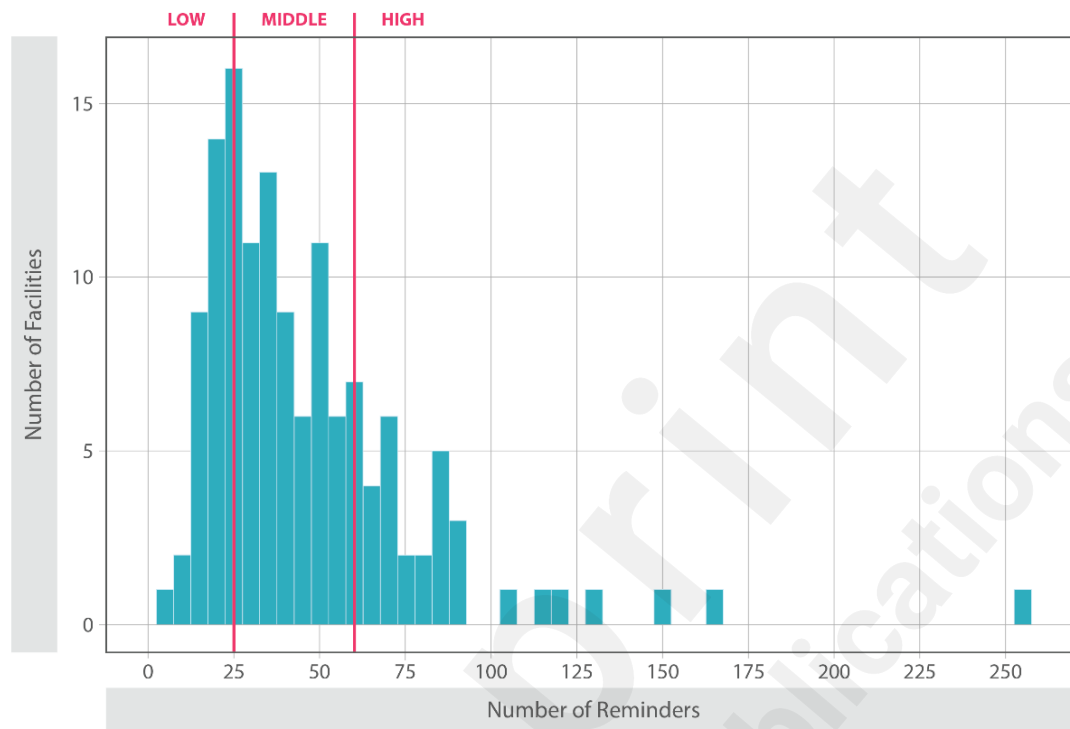


Figure 1: Number of active clinical reminders per VHA facility, stratified into three tiers representing low, middle, and high burden facilities.

Figure 2:

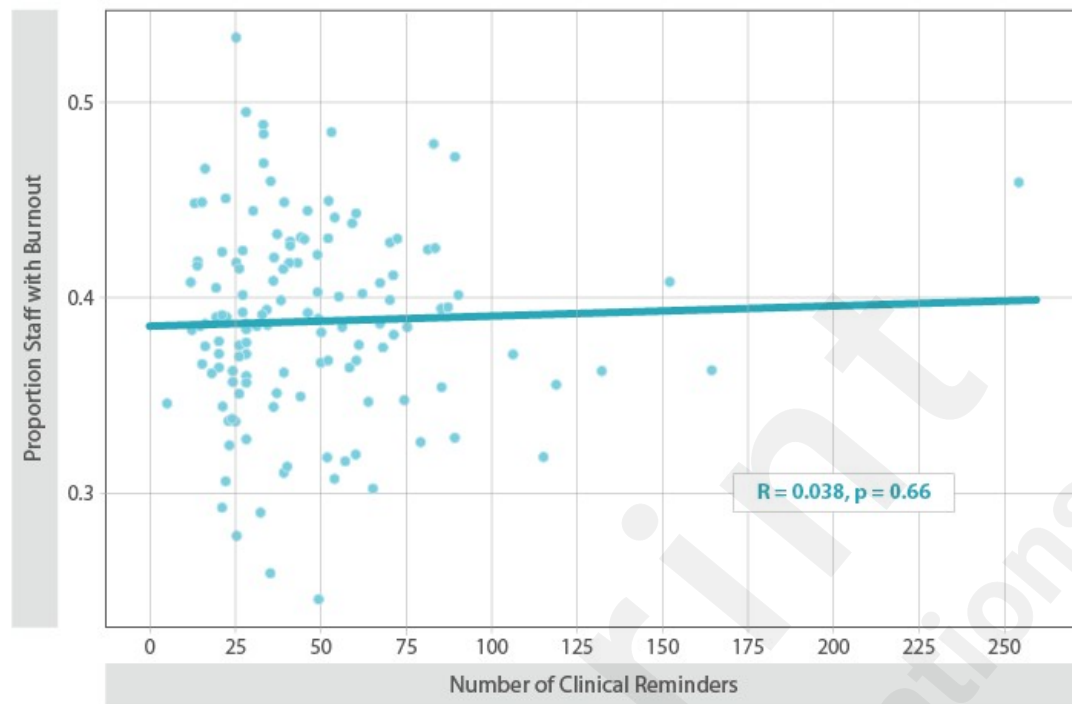


Figure 2: Comparing clinical reminder volume and primary care staff burnout at the facility level.

Appendix:

Supplemental Figure 1: Sample clinical reminder for a test patient

Vista CPRS in use by: Rolnick, Joshua A (vista.philadelphia.med.va.gov)

File Edit View Tools Help

ZZTEST.ALPHA (OUTPATIENT) 109-01-0156P Jan 01, 1966 (68) Visit Not Selected Provider: ROLNICK, JOSHUA A No PACT assigned at any VA location PDMP Query Flag JLV Remote Data No Postings

COVID-19 Not Tested

Active Problems
Problem List
No problems found.

Allergies / Adverse Reactions
Agent

Postings
Posting Date

Clinical Reminders

Reminder	Due Date
Medication Reconciliation	DUE NOW
Influenza Immunization	DUE NOW
COVID-19 Immunization	DUE NOW
Pneumococcal Conjugate Vaccine (PCV15/PCV20)	DUE NOW
Depression Screening	DUE NOW
PTSD Screening	DUE NOW
Tobacco Use Screening	DUE NOW
Screen for Abd Aortic Aneurysm	DUE NOW
Avg Risk Colorectal Cancer Screen	DUE NOW

Active Medications
Medication
No Active Medications Found

Recent Immunizations
Immunization
No Immunizations Found.

Vitals

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Supplementary Files

Supplemental Figure 1: Sample clinical reminder for a test patient.

22TEST ALPHA (OUTPATIENT) Visit Not Selected No PACT assigned at any visit location. PDM: Query Flag JLV Results Data No Postings

COVID-19 Not Tested

Active Problems: No problems found.

Allergies / Adverse Reactions: Agent Posting Date

Active Medications: Medication No Active Medications Found.

Recent Immunizations: Immunization No Immunizations Found.

Clinical Reminders

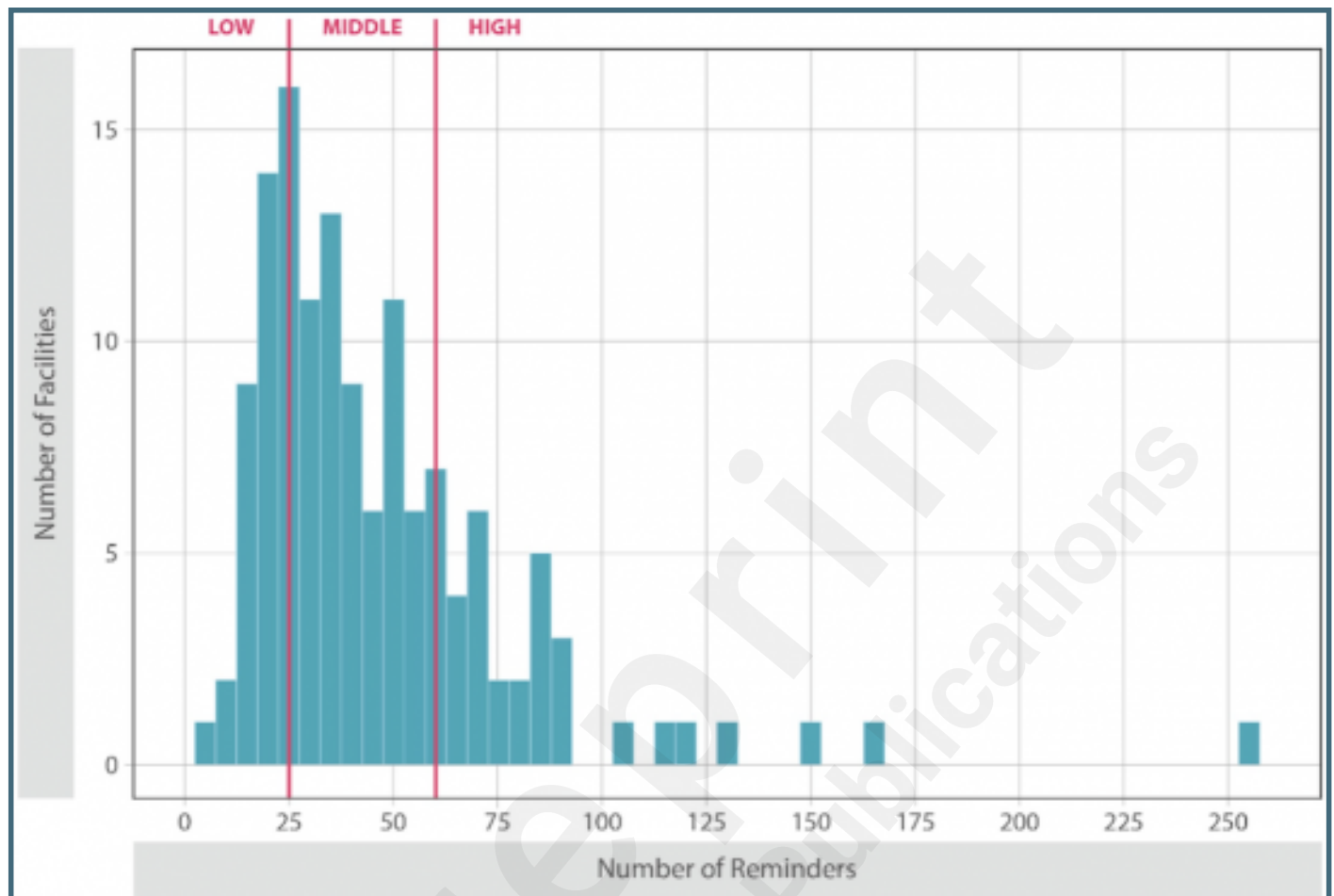
Reminder	Due Date
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Figures

Number of active clinical reminders per VHA facility, stratified into three tiers representing low, middle, and high burden facilities.



Comparing clinical reminder volume and primary care staff burnout at the facility level.

