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# Adherence to Computerized Clinical Reminders in a Large Healthcare Delivery Network

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**Abstract**

***Objective:*** *To evaluate clinicians' adherence with clinical reminders (CRs) across multiple ambulatory practice settings in an integrated health care network.*
***Materials and Methods:*** *Adherence rate to 15 CRs, integrated into a computerized patient record system, was evaluated for 451 clinicians in 49 clinics from eight Veterans Affairs (VA) medical centers.*
***Results:*** *Overall, mean rate of adherence to CRs for all clinics was 86.2%, with a range of 66.59% to 97.08% (P<.001). The hepatitis C risk assessment reminder was found to have the highest overall adherence rate (95.9%) and the tobacco use cessation had the lowest adherence rate (62.9%). Mean adherence rate for all reminders was 80.34% (P<.001). Mean adherence rate for individual clinicians was 82.6%, with a range of 29% to 100%.*
***Conclusion:*** *While overall adherence to CRs was high, there is significant variation by clinic, individual clinician and individual CR. Understanding this variation is critical in directing future efforts to improve the contribution of computerized CRs to quality and cost-effectiveness of care, and to decrease undesirable variation in clinical practice. Further research is needed to systematically evaluate clinician, reminder and systems related factors that influence adherence to CRs.*

***Keywords:***

Reminder systems, computerized medical record, quality of health care.

## Introduction

Computer-based clinical reminders (CRs) have been shown to improve adherence to clinical practice guideline and specific standards of care [1], to improve quality and cost-effectiveness of care, and to decrease undesirable variation in clinical practice [2-5]. However, relatively little is known about the rates and trends of clinicians' adherence to CRs in ambulatory settings in large healthcare networks.

The objective of this study is to evaluate clinicians' adherence to a standardized set of CRs across multiple ambulatory clinics in an integrated health care network of the Veterans Health Administration (VHA).

The VHA has been a national leader in leveraging information technology to deliver high quality of care. A decade ago, VHA mandated implementation of a computerized patient record system (CPRS) throughout its nationwide healthcare network.

Automated CRs are now a major component of the CPRS. CRs provide clinicians with necessary decision-support tools to perform as well as document healthcare maintenance at the point of care. The primary goals of CRs are to implement practice guidelines consistently across the VHA facilities, and to facilitate the practice of evidence-based medicine. In addition, CRs provide mechanisms to measure and track adherence of clinicians to standardized practice guidelines.

## Materials and Methods

### Participants

The study included 451 primary care providers (Physicians, Nurse practitioners and Physician Assistants) in 49 clinics affiliated with eight Veterans Affairs (VA) medical centers. These medical centers constitute the VA New England Healthcare System (also known as the Veterans Integrated Services Network 1 (VISN 1)). VISN 1 clinics cover the six New England states and serve a total veteran population of approximately 1.3 million.

### Clinical Reminders at VISN 1

CRs have been uniformly implemented in all clinics for all primary care clinicians in VISN1 since the year 2001. Although, the VHA provides national guidelines regarding the scope of CRs throughout the country, CRs are developed and implemented locally by VISN 1.

In CPRS, each CR is classified as either "applicable" or "not applicable" for each patient. Each applicable reminder is also classified as either "satisfied" or "due" at any given time. Applicable and due status of CRs for a patient is displayed based on clinical data in real-time and is determined based on patient's diagnoses, laboratory results, and demographic characteristics (such as age, gender). For example, for a patient with a diagnosis of diabetes mellitus, annual hemoglobin A1C (HbA1c) measurement is an "applicable reminder". The CPRS automatically evaluates the laboratory profile of this patient to determine whether HbA1c testing was performed within the last year. If a test result is found in the system, the reminder is automatically "satisfied". If no results for HbA1c are found, then the reminders appear as "due". In the case of the HbA1c reminder, appropriate documentation of non-VA lab testing by the clinician can also satisfy the reminder.

Due reminders are displayed on the first screen of a patient record (called 'cover sheet') in the CPRS (Figure 1). After reviewing due reminders, clinicians select a CR which opens a "dialog box" (Figure 2). Completing the information in the dialog box allows the clinician to resolve the reminder and perform clinical documentation in one seamless step.

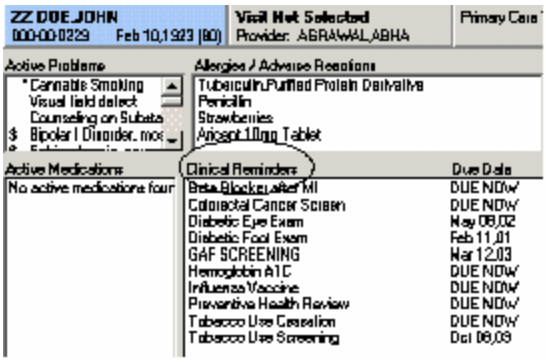


*Figure 1 - Screen shot of the cover sheet in CPRS for a sample patient displaying due reminders*

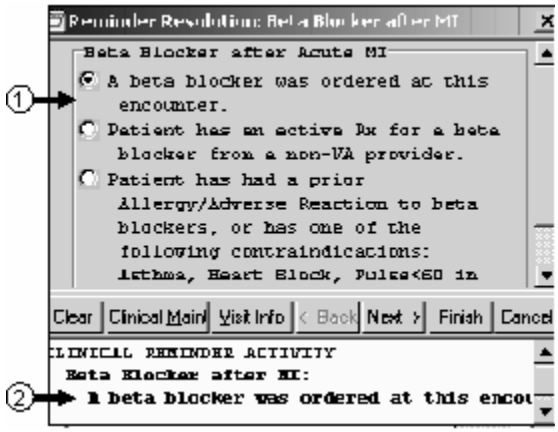


*Figure 2 - Screen shot of a Dialog Box for a clinical reminder. The upper panel (1) displays options to satisfy the reminder. The lower panel (2) displays the text that is automatically entered into the computer*

### Study Design

This is a descriptive study, performed as a quality improvement project, to evaluate adherence of clinicians to a set of 15 reminders that are being used actively by primary care clinicians in VISN 1 (Table 1).

Data collection for the study consisted of standardized reporting of adherence rate for a 30-day period in the year 2003. Adherence rate measurement uses a patient's last visit as a reference point and is determined by calculating the total numbers of "applicable reminders" and "due reminders" for a given period, as shown in Equation (1). This report was generated using VA's reminder reporting software.

Rate (%) = [(Applicable CR – Due CR)/Applicable CR] x 100 (1)

Because each site is provided some flexibility in implementing specific reminders, both investigators manually examined various reminder reports to ensure that a uniform set of reminders was being reported and that the adherence rates were being measured accurately and consistently.

*Table 1: 15 clinical reminders evaluated in the study*

| | |
|---|---|
| 1 | Aspirin after acute MI |
| 2 | Beta blocker after MI |
| 3 | Colorectal cancer screening |
| 4 | Diabetic eye exam |
| 5 | Diabetic foot exam |
| 6 | Hemoglobin A1c |
| 7 | Hepatitis C antibody testing |
| 8 | Hepatitis C risk assessment |
| 9 | Influenza |
| 10 | Mammogram |
| 11 | Pap smear |
| 12 | Pneumovax |
| 13 | Preventive health review |
| 14 | Tobacco use cessation |
| 15 | Tobacco use screening |

## Results

We evaluated a total of 451 clinicians (including Physicians, Nurse practitioners, and Physician's Assistants) in 49 VA clinics for adherence to 15 reminders (Table 1). For all clinicians at all sites for a 30-day period, a total of 128,747 reminders were reported as applicable and 110,979 reminders 17,768 as due.

Among the 49 clinics, the overall mean rate of adherence to all reminders was 86.2%, with a range of 66.59% to 97.08% (Figure 3). Using chi-square analysis and a null hypothesis that the performance at all sites was equal; the probability that this variation occurred by chance alone was at p value of <0.001. This indicates a statistically significant variation in adherence rate among clinics. Figure 4 shows the distribution of adherence, grouped by % rate of adherence.

Among the 451 clinicians, the overall mean rate of adherence was 82.6%, with a range of 29% to 100%. Figure 5 shows the distribution of adherence among clinicians.

Overall mean adherence rate for reminders was 80.34% (Figure 6). The p value for this variation using chi-square analysis was <0.001.

## Discussion

VHA has invested substantial resources in developing and implementing CRs as well as training clinicians in efficient use of CRs. CRs are a major focus area for quality improvement initiatives at VISN 1. To measure quality of care, VHA uses an external peer review program (EPRP) to audit medical records for completion of a variety of prevention, chronic disease and acute care indicators.

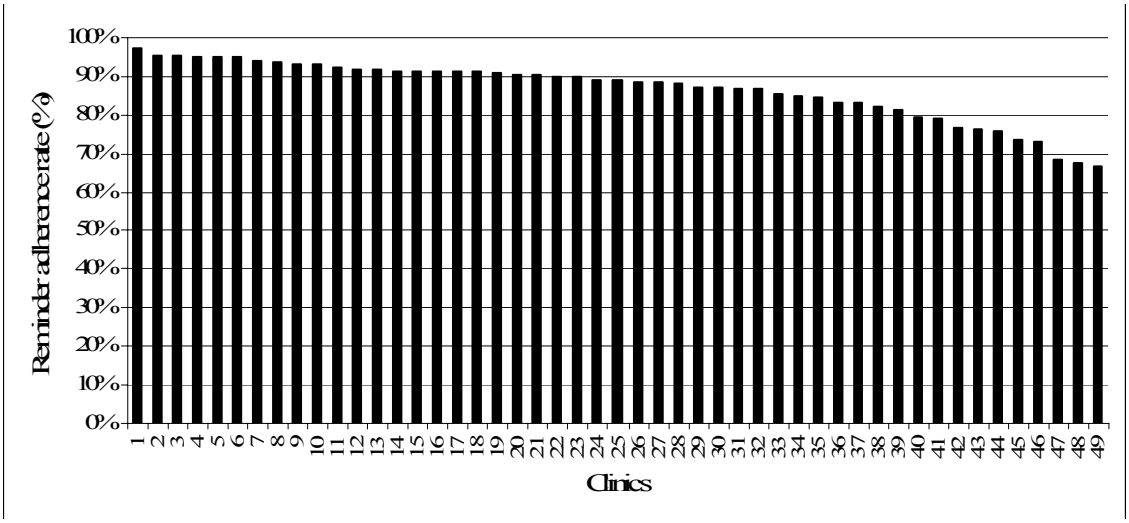


*Figure 3 - Adherence rate of 49 clinics to all clinical reminders*

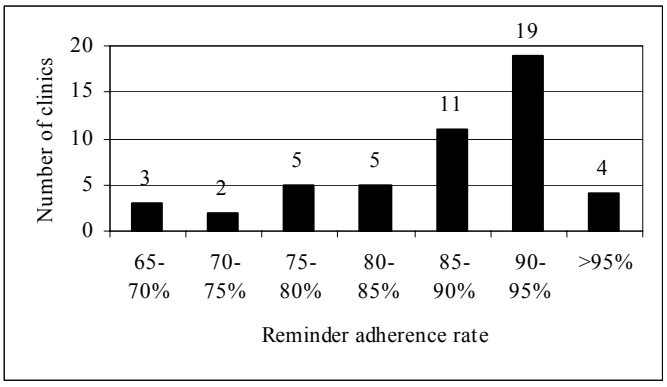


*Figure 4 - Distribution of adherence rate among clinics*

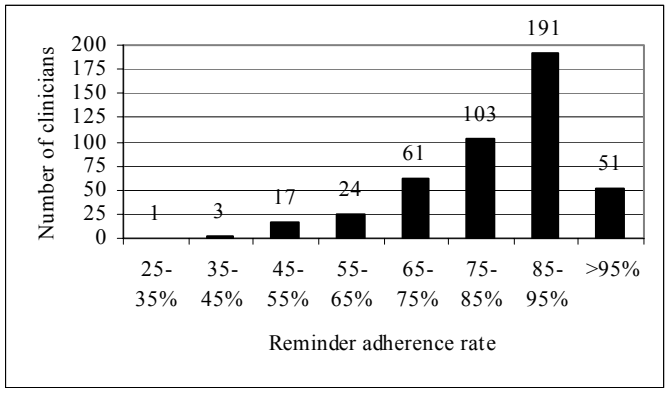


*Figure 5 - Distribution of adherence rate among clinicians*

Completion of CRs by clinicians is an important component of EPRP compliance, and VISN 1 has demonstrated significant improvements in quality of care outcomes related to primary care following its implementation of standardized CRs. Thus further improvements in CR adherence represent an important approach to additional gains in quality of care.

This study of evaluation of adherence to CRs was unique in involving multiple clinics within an integrated healthcare network, in having large sample size, and in measuring both preventive measures as well as treatments for specific diagnoses.

The study demonstrated an overall high adherence rate to CRs. There was a wide range of adherence rate among providers (29 – 100%). Our sample of clinicians included people of varying professional background (physicians, nurse practitioners and physician assistants) as well as both housestaff and attending physicians. Further research is needed to study whether these and other demographic factors such as age, years since graduation, and attitudes toward CRs have a significant influence of clinicians' adherence to CRs.

The study also demonstrated a difference in mean adherence rate among various CRs. A possible explanation may lie in reminder-related factors such as usability of a CR, perceived clinical relevance of a CR, and how frequently the reminder is considered 'due' by the system [6, 7]. For example, a reminder which is 'due' every visit (such as tobacco use cessation) is likely to have lower adherence rate than a reminder which is 'due' once in a lifetime (such as hepatitis C risk assessment).

Specific workflow issues at various clinics may also influence overall CR adherence rate. At some clinics, licensed nurse practitioners and registered nurses interview the patient and are able to resolve questionnaire type reminders (such as preventive health review). We think these sites are likely to have a hadherence rate than the sites where clinicians are responsible for administering all.

In addition to studying factors that affect adherence rate, additional research studying the effect of specific interventions, such as additional training of clinicians, on adherence rates would also be valuable. The large number of clinics and providers in this healthcare system, all using a standard set of CRs, offers a natural "laboratory" in which such studies could be performed.

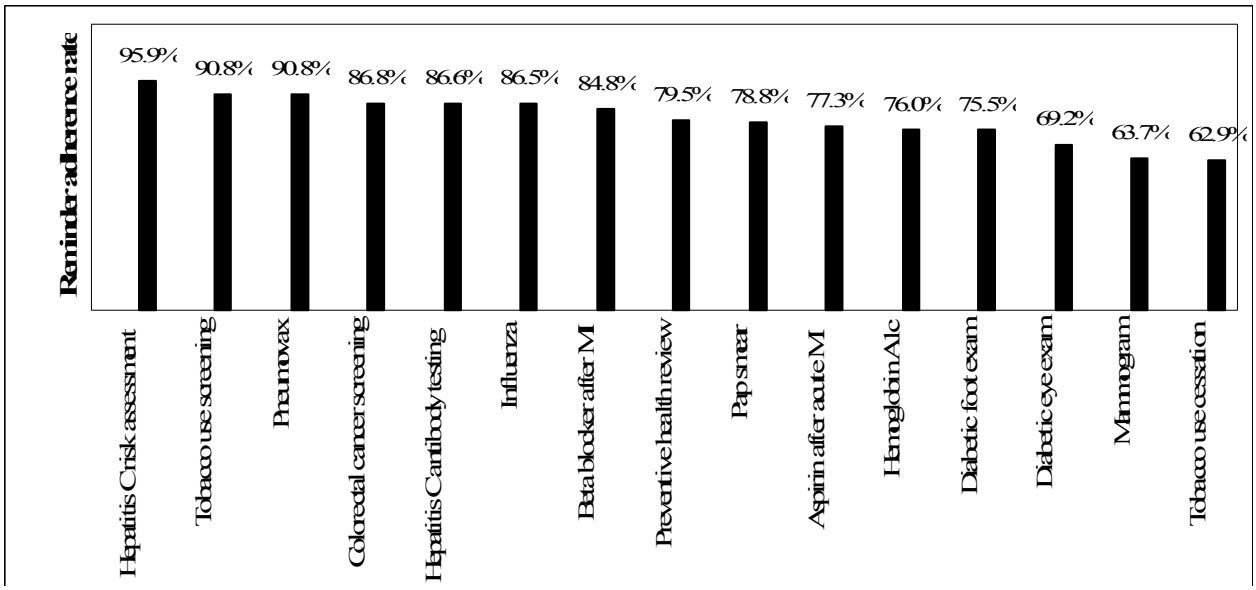


*Figure 6 - Adherence rate of clinical reminders for all clinics*

## Conclusion

Overall, clinicians in the VHA's New England healthcare system had a high adherence rate to computerized clinical re-minder. However significant variation in adherence to CRs by clinic, individual clinician and individual CR were found. Understanding this variation is critical in directing future efforts to improve quality and cost-effectiveness of care, and to de-crease undesirable variation in clinical practice. Further re-search is needed to systematically explore clinician, reminder and systems related factors that influence adherence to CRs.

### Acknowledgements

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