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Computerised Clinical Reminders Use in an Integrated Healthcare System

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ABSTRACT

Objective: To examine levels of routine computerised clinical reminder use in a nationwide sample of primary care physicians and to identify factors influencing reminder use.

Design: Cross-sectional using a self-administered questionnaire.

Setting: The United States Veterans Health Administration.

Methods: Survey responses from 461 VHA primary care physicians sampled from across the Veterans Health Administration were sampled and analysed. We asked physicians how many computerised clinical reminders they use per patient per visit and when they typically use computerised clinical reminders in their clinics. Measured physician characteristics included age, gender, year of medical degree, number of days in clinic per week, and attitudes towards computerised clinical reminders (measured on Likert-like scales). We used multivariable linear regression to determine factors associated with greater use of computerised clinical reminders per patient per visit.

Results: Average computerised clinical reminder use per patient visit was 4.2 (SD = 2.5). Eighty-six percent of physicians resolve reminders during the visit. In a multivariable regression model, a higher score on the team factors scale is associated with use of more reminders (increase of 0.24 reminders for each unit increase on the team factors scale, or one extra reminder for each four unit increase in the team factor scale). Working more days in clinic is associated with use of more reminders per patient visit (increase of 0.13 reminders for each extra half-day of clinic per week, or about one additional reminder for physicians working ten half-days per week versus physicians working two half-days per week). Academic facility affiliation is associated with one less reminder used per patient visit as compared with no affiliation.

Conclusions: Most United States Veterans Health Administration primary care physicians use computerised clinical reminders, typically during the patient visit. Strategies to increase reminder use should focus on improving physicians' understanding of their role in completing reminder-related tasks and improving usability for users such as physicians who work in clinic less frequently.

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INTRODUCTION

Studies suggest that providers often fail to deliver recommended care[1,2]. One quality improvement method that has met with some success in ensuring that patients receive recommended care is to prompt primary care physicians at the point-of-care through the use of computerised clinical reminders[3–6]. The United States Veterans Health Administration (VHA) is an integrated nationwide healthcare system that has been a leader in developing and implementing an electronic health record with computerised clinical reminders[4,5]. However despite all the VHA's development and implementation efforts, little information is available about patterns of VHA physicians' reminder use across the VHA healthcare system[9].

VHA primary care physicians have access to reminders related to preventive care (e.g. influenza vaccination, colon cancer screening, post-traumatic stress disorder screening, hepatitis C risk factor screening) as well as chronic care management (e.g. diabetes-related laboratory tests and medications), when entering their clinic notes[9,10]. These patient-specific reminders are driven by information embedded in the electronic health record. A physician's use of the reminders is comprised of the following steps:

(i) View the list of reminders
(ii) Click on a particular reminder title, which causes the content of the reminder to appear in an inset window
(iii) Resolve the reminder by entering into specified fields responses, which are in turn inserted automatically into the clinic note (Figure 1; Appendix A).

Many of the reminders are based on performance measures that are determined and comparatively assessed at a national level[9]. Use of reminders may help primary care physicians better adhere to performance measures[7]. Individual VHA facilities may develop and implement their own reminders, for example to improve performance on particular measures[7]. Reminders may also be developed at the national level – some are mandated for use in all VHA facilities, while others may be customised or not used at all in certain VHA facilities (determined by local leadership)[6].

Overall, few studies have been published regarding levels of reminder use[12,13]. Although research studies suggest that reminders improve clinical practice[8–13], clinical reminders will be ineffective if they are not actually used by physicians. We previously identified predictors of higher global ratings of VHA reminders, using an index that summarised physicians' satisfaction and perceived usefulness of reminders[14]. However while attitudes may influence usage they do not necessarily predict actual behaviour[15]. Studies on the adoption of other forms of health information technology[16,17] provide insight into facility- and provider-level factors that may affect adoption and implementation of reminders. A directed study in a healthcare system might provide additional understanding of factors that drive and inhibit higher levels of adoption of clinical reminders.

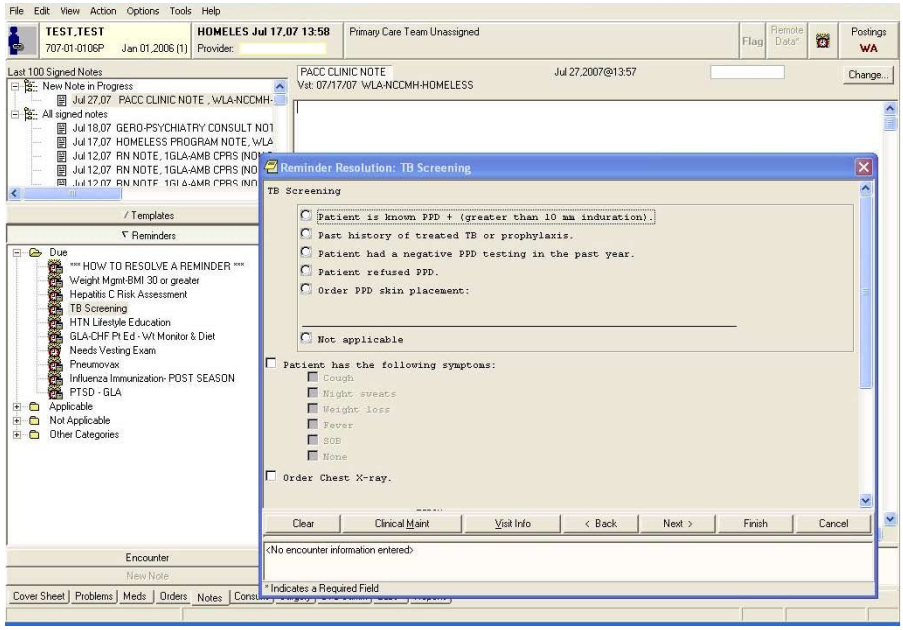

Figure 1. *Example of VHA Computerised Clinical Reminder for tuberculosis screening. The list of reminders that are due for the fictional patient is on the left side of the screenshot. The inset window, "Reminder Resolution: TB Screening," shows the list of responses that the clinician can select to resolve the remainder.*

Estimating actual physicians' reminder use in a nationwide sample poses a challenge, because methods for estimating use are subject to various biases, difficulty in data acquisition, and imprecision. One method for assessing levels of reminder use would be direct observation, but this method is subject to attention bias (Hawthorne Effect) and is complicated by the need to arrange multiple observations of clinicians across many facilities, which makes this method prohibitively costly. A second method is chart review and abstraction, but this method necessitates arranging reviews across numerous facilities. A third method would be to use a data repository to track which reminders were used. However, at present, the VHA does not have a national data repository for all reminders in use at its healthcare facilities. Moreover, there is no uniformity of reminder data elements across facilities' data repositories. In contrast to these methods, a self-administered questionnaire that is grounded in a theoretical framework and whose items are shaped by data collected from direct observation, focus groups, and a pilot survey, is a practical and straightforward method for obtaining exploratory data from a large nationwide sample.

Based on this premise, we administered a nationwide survey to VHA primary care physicians, with the objective of evaluating levels of reminder use among pri-

mary care physicians. A secondary goal was to identify predictors of reminder use at the physician and facility level in an effort to better understand what may promote and impede reminder use across a national healthcare system.

METHODS

Data Sources, Sampling Methods, and Data Collection

Our survey data sources, sampling methods, including our sampling strategy and eligibility criteria, and data collection have been described in detail in a prior paper[14]. We used cross-sectional survey data from a nationwide sample of VHA primary care physicians. The list of primary care physicians (internists, family physicians, geriatricians) in the VHA Personnel and Accounting Integrated Data database was our sampling frame. Trainees (housestaff and medical students) are not included in the database. We took a stratified random sample. In one stratum consisting of four sites (Los Angeles, Cincinnati, Indianapolis, Minneapolis), we sampled all primary care physicians (21% of the unweighted total sample came from these sites). In the other stratum (all remaining VHA sites), we randomly sampled primary care physicians (sampling fraction, 15%).

Between March and October 2005, we collected data in three overlapping waves (web-based, paper, telephone). Careful records were maintained to ensure that each physician only submitted one set of responses; no duplicate responses were received. Non-responders to the web and paper survey were contacted by trained staff, who provided the physician with the option to respond by telephone or to receive another copy of the questionnaire and who documented which option the physician selected. Four hundred and three physicians completed the survey via the web. Ninety-eight physicians completed a paper version. Sixty-nine physicians completed the survey via interview. Our weighted sample response rate was 69% (four sites 66%; other VHA sites 69%). Physicians were eligible to participate if they provided at least one half-day of direct patient care per week, confirmed that they have a primary care specialty (internal medicine, geriatrics, family practice), and reported ever using a VHA reminder (never used VHA reminder n = 31). Information on non-respondents was not collected.

Dependent Variable

Our dependent variable, reminder use per patient visit, was an item from the questionnaire, "On average, how many reminders do you use per patient? [per visit]" (response range: 1 to 11+).

Independent Variables

Physician characteristics included gender, specialty, academic appointment, years since medical school graduation, VHA tenure, and physician's number of half-days per week in clinic. Facility characteristics include urban/rural setting, number of

patient visits, academic affiliation, and geographic region. Data collection mode (web, paper, telephone) was also considered.

The following scales representing physicians' attitudes towards reminders (based on Patterson's conceptual framework of reminder usability[18]) were also considered (see Appendix B for scale components and reference[14] for scale development details): (1) global assessment of reminders (3 items, Cronbach's α = 0.79, range 0–21), (2) self-efficacy (9 items, α = 0.68, possible range 0–63), (3) perceived role in reminder use (team factors scale; 2 items, α = 0.72, range 0–14), (4) design/interface factors (6 items, α = .082, range 0–42), (5) sources of training (4 items, α = 0.76, range 0–28), (6) VHA management of reminders (1 item, range 0–7), (7) clinical/situational specificity (4 items, α = 0.62, range 0–28); and (8) integration with workload/workflow (3 items, α = 0.69, range 0–27). Higher scores on the scale indicate a more favourable attitude towards reminders.

Analytic Strategy

Main analyses: After testing bivariable relationships, we constructed a multivariable linear regression model to measure the association between independent variables and the number of reminders used per patient visit, weighting the data per the sampling frame and finite population. Initially, we fitted a full model, which included all of the independent variables described above (Appendix C). Then, to select a parsimonious model, we employed a genetic algorithm[19,20], using as our fitness function Akaike's Information Criterion[21], which balances explanatory power and parsimony, and offers a better method of selecting a parsimonious model. Variables are not inspected individually, but as a group, which provides the opportunity to include variables with important influence that nevertheless do not reach the level of statistical significance and to address the issue of confounding. Additionally, information criteria are naturally designed to select for parsimony since they penalise the inclusion of additional parameters. We then applied a genetic algorithm, which broadens the search space and narrows the field of promising candidates, to find an optimal (parsimonious) model. Our algorithm ran for 83 generations and evaluated 4,054 possible models. We selected the model with the best Akaike's Information Criterion as our parsimonious model.

Additional Analyses

Hierarchical linear mixed model: We also considered that usage within each site might be correlated. Accordingly, we used a hierarchical linear mixed model, with subjects each assigned to one of five clusters (the four over-sampled sites each constituted a cluster; the remaining, sparsely-sampled sites were one cluster). Adjusting for the covariables in Table 1, the intra-facility correlation was 2%, demonstrating that variation in physicians' use of reminders within facilities greatly outweighs its variation across facilities. This suggests that the characteristics of individual physicians and the characteristics of the facilities in which they practice determine the

extent of reminder use far more than the particular facilities to which they are affiliated. Additionally, in our sample, the majority of the facilities are represented by few physicians (in our analysis data set, 87% were represented by 3 or fewer physicians). We therefore opted to conserve statistical power and present the results for our (non-hierarchical) linear regression model, using as our threshold for statistical significance $\alpha = 0.05$.

Sensitivity Analysis

For 21% of facilities (mostly satellite clinics of main hospitals), we were missing data on academic affiliation. In the main analysis described above, we included all facilities in the analysis and assumed that facilities with missing academic affiliation data were not academically-affiliated. In a sensitivity analysis, we restricted the analysis to facilities that had data available on academic affiliation. In a second sensitivity analysis, we included all facilities in the analysis, but assumed that facilities with missing academic affiliation data were academically-affiliated.

RESULTS

Descriptive Statistics

Table 1 displays the characteristics of the physicians and the facilities they worked in. The average number of reminders used per patient visit was 4.2 (standard deviation = 2.5, interquartile range: 3–5). Most respondents (86%) resolved reminders during the visit, 1% prior to the visit, and 12% after the visit.

Main Analyses and Sensitivity Analyses

Table 2 presents the results of our parsimonious model. Comparison of these results to those of the full model (Appendix C) shows stability in the estimates of the parameters' effects.

Physicians who work more days in clinic reported using more reminders per patient per visit (increase of 0.13 reminders for each extra half-day of clinic per week, or about one additional reminder for physicians working ten half-days per week versus physicians working two half-days per week). Physicians who worked in the VHA for five to nine years were more likely to report a larger number of reminders per patient visit (0.90 more reminders compared with physicians who had worked in the VHA for five years or less or for fifteen years or more). Working in the VHA for ten to fourteen years was not predictive of reminder use ($p > 0.05$). Family physicians used fewer reminders (0.60 less reminders) as compared with general internists or geriatricians, although our study had few family physicians. A facility that has seventy-one times more patient visits than another facility has physicians that use one more reminder per patient visit; however, the parameter estimate for this variable was not significant in the full model. Gender, years in practice, physician's academic affiliation, and facility location were not significant predictors of reminder use.

Table 1. *Physician and Facility Characteristics (Weighted) (n = 461)*

Variables	Weighted Frequency
Physician-Level Variables	
1) Length of VHA service	n (%)[1]
<5 years	232 (50)
5 to 9 years	104 (22)
10 to 14 years	48 (10)
>15 years	78 (17)
Missing	0 (0)
2) Specialty	
Internal medicine	369 (80)
Geriatrics	31 (7)
Family practice	61 (13)
Missing	0 (0)
3) Gender	
Female	185 (40)
Male	276 (60)
Missing	0 (0)
4) Has academic appointment	
Yes	213 (46)
No	235 (51)
Missing	13 (3)
5) Number of half-days of direct patient care, median (interquartile range)	9 (5–10)
Missing	2 (1)
6) Years since medical school graduation, median (interquartile range)	19 (11–27)
0–12 years	127 (28)
13–25 years	209 (45)
26 or more years	124 (27)
Missing	1 (0)
7) Self-reported reminder use per patient per visit, median (interquartile range)	4 (3–5)
Facility-Level Variables	
8) Academic affiliation	n (%)[1]
Yes	294 (64)
No	37 (8)
Missing	131 (28)
9) Located in metropolitan area, N (%)[1]	
Yes	387 (84)
No	75 (16)
Missing	0 (0)
10) Number of primary care visits (Fiscal Year 2004), median (interquartile range)	148,000 (65,000–296,000)
Missing	0 (0)

[1] Percentages for this variable do not sum to 100% because of rounding.

Table 2. *Weighted Linear Regression Model for Level of Computerised Clinical Reminder Use among Physicians – Parsimonious Model (N = 415)*

Variable	Parameter Estimate (95% Confidence Interval)
Intercept	–1.63 (–4.68, 1.42)
Specialty	
General Internal Medicine or Geriatrician[1]	Reference
Family physician	–0.60 (–1.18, –0.03)*
Number of clinic half-days	0.13 (0.06, 0.21)*
Physician academic affiliation	0.15 (–0.33, 0.64)
Years in VHA	
0–5 years or 15 or more years[1]	Reference
5–9 years	0.90 (0.27, 1.53)*
10–14 years	–0.48 (–1.18, 0.22)
Primary care patient visits (log_{10})	0.55 (0.04, 1.06)*
Facility academic affiliation	–0.96 (–1.63, –0.28)*
Geographic region	
South or West[1]	Reference
Northeast	0.43 (–0.12, 0.97)
Midwest	–0.40 (–0.96, 0.15)
Physician assessment of reminders	
Clinical/situational specificity	0.00 (–0.05, 0.06)
Global assessment	–0.01 (–0.10, 0.08)
Self-efficacy	0.01 (–0.02, 0.05)
Integration with workload/flow	–0.09 (–0.17, –0.02)*
Training	0.04 (–0.01, 0.08)
Software design/interface	–0.00 (–0.05, 0.05)
Team factors (Perceived role in reminder use)	0.24 (0.15, 0.32)*

[1]Variables were treated individually during the model selection to allow for non-monotonicity of effect, but are presented in the same row because both variables are omitted in the parsimonious model and hence the reference group is their combination.
*$p < 0.05$

Greater integration into workload/workflow was associated with decreased reminder use per patient visit (decrease of 0.09 reminders for each unit increase in the workload/flow scale, or one fewer reminder for each ten unit increase on the workload/flow scale). Higher responses on the team factors scale (e.g. feeling responsible for completing reminders and knowing which reminders are assigned to physicians) were associated with greater reminder use per patient visit (increase of 0.24 reminders for each unit increase in the team factors scale, or one extra reminder for each four unit increase in the team factor scale). The following scales

failed to reach statistical significance: clinical/situational specificity, self-efficacy, training, software design/interface, organisation's management of reminders, and global assessment of reminders.

Facilities with an academic affiliation had lower reminder use per patient visit (0.96 fewer reminders compared with non-academically affiliated facilities). When we restricted the analysis to facilities that had data available on academic affiliation, we found a stronger effect. When we assumed that facilities with missing academic affiliation data were academically-affiliated, the effect was diluted and no longer achieved statistical significance.

DISCUSSION

We found that computerised clinical reminders have become part of routine VHA primary care practice, with primary care physicians reporting use of approximately four reminders per patient visit. Use of reminders was typically during a clinic visit, i.e. with the patient present. This is reassuring because an earlier observational study at four VHA sites conducted by members of our project team found that the majority of providers resolved reminders after the patient visit[22]. Our results thus suggest that reminders have overcome a significant implementation hurdle and are now routinely integrated into VHA primary care practice. We also found that physicians who provide more direct patient care, have a higher perceived role in reminder use, or have worked in the VHA for a moderate amount of time (i.e. 5 to 9 years) report greater reminder use per patient visit. On the other hand, facility academic affiliation predicted decreased reminder use. Furthermore, while we postulated that training, global assessment, and self-efficacy might predict increased reminder use, our results did not support these hypotheses. We discuss below in greater detail the implications of our findings.

First, the present study suggests that physicians who work more days in clinic use more reminders per patient visit, even though, as shown in our prior analysis[14], the number of days a physician is in clinic is not associated with physicians' satisfaction with the reminders. We suspect that physicians who have more direct clinical responsibility may be more familiar with the VHA's performance measures and/or may feel greater personal responsibility for meeting performance targets. Those clinicians who spend more time in direct patient care may recognise the linkage to performance goals and/or may be more familiar with reminders. However, since not all physicians will work similar hours in direct patient care, strategies to enhance reminder use for all physicians might include the following: (1) highlight critical reminders with an asterisk, which sorts them automatically at the top of the list[23]; (2) improve ease of use – such as by allowing access from various parts of the electronic health record – so that first-time and infrequent users can more easily overcome any unfamiliarity with reminders; (3) employ a standard "What–When–Who" format (e.g. Depression screen – At least once per year – All

[patients]) for each reminder to facilitate quick scanning of the text the first time it is accessed.[26]

Second, we found that a physician's perceived role in completing reminders is associated with reminder use. Our findings suggest that clarifying which healthcare team members are responsible for completing the various reminders may increase reminder use, even if it does not result in more satisfaction with the reminders.[14] For example a reminder could include "P" to designate physician and "N" to designate nurse for completion.[23] Regularly pruning the list of reminders so that it contains only evidence-based reminders which are deemed as high-priority quality improvement targets, could help ensure that physicians view reminders as part of their core activities. We observed this approach in one hospital in our observational study.[23]

Third, this study shows that physicians practicing at the VHA for five to nine years are more likely to report using more reminders than physicians who have practiced fewer than five years or 10 years or more. When our survey occurred, physicians within the five to nine year timeframe may have been simultaneously more integrated in the healthcare system and experienced in using information technology and thus more inclined to use the reminders. This group may have represented a "*sweet spot*" when a secular trend and years in the VHA system combined proficiency with computers with sufficient VHA-specific clinical experience. However, since our study is cross-sectional we do not know if this is a constant relationship or will change over time.

Finally, we found that physicians who perceive more workload/workflow, report use of more reminders. We expected that these physicians would report using fewer reminders. We may not have adequately measured an underlying construct – overall job dissatisfaction related to workload – which would explain the lower ratings on the integration with workload scale and a tendency to report more reminder use (more work). Another underlying construct that could explain our results is physician conscientiousness, i.e. conscientious physicians will want to address all reminders and thus may perceive greater workload because they are simultaneously trying to accurately code visits, address all patient complaints, and write thorough clinic notes. Alternatively, the use of more reminders may be leading to negative ratings on the workload/workflow scale.

Several predictors of lower levels of reminder use were also identified. Facilities with academic affiliation used fewer reminders, although the academic affiliation of individual physicians was not a predictor of reminder use. This may suggest a system's effect in that non-academically-affiliated facilities may have more successfully developed a culture of commitment to meeting VHA performance targets through use of reminders.

Our study's findings on nationwide levels of use of reminders and barriers and facilitators to reminder use contribute to the limited body of literature on these topics. The measures used in other studies differ from our study, making direct comparisons difficult. For example, one study evaluated adherence rate in eight VHA

facilities and found the mean rate of adherence to reminders ranged from 67 to 97% (mean 86%).[24] In another study, investigators searched for factors associated with greater levels of information technology clinical support for quality improvement (including reminder use) and found that support was higher in hospitals that were urban and had cooperative cultures.[25] One study found that physicians exposed to lipid management reminders were more compliant with the reminders when they experienced greater patient load.[26] A study conducted at Kaiser evaluated the effects of clinical workload and perceived lack of time on reminder use.[27] Finally, a provider survey on attitudes towards clinical guideline adherence and electronic reminders found that 51% of physicians identified lack of time to be a barrier to guideline adherence.[28]

Our study has several limitations. First, we relied on self-report and our findings are subject to the biases of using questionnaires to ascertain behaviour. On the other hand, as mentioned above, this study complements findings from interviews and direct observations that members of our project team used to evaluate reminder use in a subset of the facilities included in this study.[23] Second, we could not account for facility- or clinic-level variations in the number of reminders (i.e. primary care physicians from different facilities may see varying numbers of reminders depending on how many are implemented at that given facility (or clinic)). However, we know from a previous study that most facilities implement at least ten reminders.[29] Third, we surveyed only primary care physicians in the VHA system. This limits generalisability to other groups (e.g. specialists, nurses) and/or healthcare systems, who have different patterns of reminder use.[30] Nevertheless, because the VHA's implementation of reminders serves as a model for many other systems, particularly integrated ones, lessons learned from within our system may be helpful to others.

In conclusion, this study provides previously unavailable information about levels of reminder use across the United States VHA. These findings are important, because the impact of computerised clinical reminders on quality of care depends, in part, on whether and how they are used. We found that in the context of a large healthcare system with a well established electronic health record, along with its global performance measurements, reminders are now routinely used by a preponderance of primary care providers. While reassuring, there is little doubt that gaps remain in intended usage. Future efforts to improve quality with reminders should take these organisational factors into account and should focus on exploring in greater detail the relationship between academic affiliation and workload/workflow and reminder use. Finally, future research should aim to implement and measure the impact of strategies such as explicitly allocating reminders to particular personnel (nurse, physician) or highlighting which reminders are tied to performance measures.

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APPENDIX A

Resolution of the reminders by clinicians (physicians, nurse practitioners, physician assistants, and nurses) requires the clinician to perform a five-step process: 1. Activate a clinic note, which is typically the one that the clinician is already using

to document the clinical encounter; 2. Click on the "reminder button," which gives the clinician access to a list of reminders by expanding a small window set next to the clinic note; 3. Select a particular reminder, which in turn exposes the text and details of the reminder in a small inset window; 4. Complete any questions that the reminder asks; 5. Save and sign the clinic note. Evidence that the reminder has been resolved is automatically documented in the clinic note. Some reminders are linked to other parts of the electronic health record so that a clinician who resolves the reminder can order laboratory tests and a specialty consult that pertains to the reminder, without navigating away from the clinic note. In theory, this feature of simultaneous documentation and ordering improves efficiency and provides an incentive to use the reminder. If the reminder is not adequately resolved, it will continue to be listed among the reminders that are "due." For example, if the reminder has pre-specified responses and the clinician does not agree with any of them, the reminder cannot be resolved and will remain "due." It is possible for clinicians to ignore all reminders. Clinicians who do not access the patient's summary page or the reminder "reminder button" may never see or use a reminder.

APPENDIX B

Scale Components

1) Global assessment: Overall satisfied with reminders; overall reminders are effective; overall reminders are not more useful in principle than in practice.
2) Clinical/situational specificity: reminder dialog boxes provide appropriate options for physician to resolve reminder; most reminders apply to physician's patients; adding "Not Applicable" would not improve use and effectiveness of reminders; adding "Pending" would not improve use and effectiveness of reminders.
3) Integration with workload/flow: Enough time to complete reminders under typical clinical workload; reminders do not unnecessarily duplicate information in my progress notes; total reminder number is not too large.
4) Sources of training help physician learn reminders: Training sessions; online documentation; performance feedback; other clinical staff.
5) Design/interface: Easy to use most reminders; easy to learn how to use reminders; expected functions and capabilities are available; formats easy to use; not surprised by actions of some reminders; information on reminder screen is presented pleasantly.
6) Management role: VHA managing of reminders increases my completion of reminders.
7) Perceived role in reminder use (team factors): Know exactly which reminders responsible for completing; views reminders as part of core work activity.
8) Self-efficacy: Reminders help physician provide care; physician feels comfortable using reminders; reminders make physician more productive; physician recovers quickly when makes mistake using reminders; enough; workstations are

available; computer speed sufficient to use reminders; has proficient computer skills to use reminders; prefers to use computer while with patient; makes no notes on paper to use later to complete reminders.

APPENDIX C

Weighted Linear Regression Model for Level of Computerised Clinical Reminder Use among Physicians – Full Model (N = 413)

Variable	Parameter Estimate (95% Confidence Interval)
Intercept	–1.37 (–4.76, 2.02)
Gender	
Male	Reference
Female	0.17 (–0.34, 0.69)
Specialty	
Internal Medicine	Reference
Family physician	–0.61 (–1.22, –0.00)*
Geriatrician	–0.42 (–1.32, 0.48)
Number of clinic half-days	0.12 (0.04, 0.21)*
Years since medical school	
0–12 years	Reference
13–25 years	0.11 (–0.66, 0.88)
26 or more years	0.15 (–0.36, 0.68)
Physician academic affiliation	0.15 (–0.37, 0.67)
Years in VHA	
0–5 years	Reference
5–9 years	0.75 (0.08, 1.43)*
10–14 years	–0.62 (–1.32, 0.09)
15 or more years	–0.23 (–0.96, 0.50)
Urban facility	0.29 (–0.36, 0.93)
Primary care patient visits ($\log_{10}$)	0.46 (–0.10, 1.02)
Facility academic affiliation	–0.90 (–1.59, –0.22)*
Geographic region	
South	Reference
Northeast	0.25 (–0.41, 0.91)
Midwest	–0.57 (–1.26, 0.11)
West	–0.39 (–1.08, 0.29)

*$p < 0.05$

Weighted Linear Regression Model for Level of Computerised Clinical Reminder Use among Physicians – Full Model (N = 413)

Variable	Parameter Estimate (95% Confidence Interval)
Physician assessment of reminders	
Clinical/situational specificity	0.01 (–0.05, 0.06)
Global assessment	–0.02 (–0.11, 0.07)
Self-efficacy	0.01 (–0.03, 0.05)
Integration with workload/flow	–0.09 (–0.17, –0.01)*
Training	0.03 (–0.02, 0.08)
Software design/interface	0.01 (–0.04, 0.06)
Perceived role in reminder use	0.21 (0.11, 0.30)*
Management role	0.12 (–0.02, 0.25)
Data collection method	
Web	Reference
Paper	–0.24 (–0.84, 0.35)
Telephone	0.30 (–0.50, 1.10)

*$p < 0.05$