



## Percentage of Alerts or Reminders That Resulted in Desired Action

Determining the frequency in which a given alert or reminder is executed may help assess its effectiveness. This measure might be implemented in the following instances:

- For evaluating a new alert or reminder to determine whether the corresponding new rule is effective. If a new alert or reminder is consistently “clicked-through,” it could be that the alert: (1) appears at the wrong time in an encounter, (2) is set to display to the wrong person, (3) is written ambiguously, or (4) is perceived by the provider to be unuseful or inappropriate.
- For evaluating the acceptance of an alert or reminder over time.

**Measure Category:** Clinical Process

**Quality Domain:** Patient Safety; Effectiveness

**Current Findings in the Literature:** Computerized alerts and reminders are displayed in response to an entered order or upon opening a patient’s record. Warnings are presented about potential hazards, and suggestions are presented for improving adherence to practice guidelines.

A significant body of literature demonstrates that alerts and reminders can improve compliance with recommended care and adherence to practice

guidelines.<sup>1 10</sup> For example, seminal work conducted at the Indiana University School of Medicine showed that physicians entered the suggested corollary orders in 46.3 percent of instances when they received a reminder in the inpatient setting, compared with 21.9 percent compliance by control physicians ( $p < 0.0001$ ).<sup>11</sup> Work by Galanter and colleagues reported reduction of inpatient administration of medications contraindicated because of renal insufficiency: the likelihood of a patient receiving at least one dose of a contraindicated drug after the order was initiated decreased from 89 to 47 percent ( $p < 0.0001$ ) after alert implementation.<sup>12</sup> In the outpatient setting, research has shown that in response to drug–laboratory interaction alerts, providers will significantly increase the ordering of appropriate laboratory tests (39 percent at baseline versus 51 percent post intervention,  $p < .001$ ).<sup>13</sup> Research also has shown the utility of alerts directed at pharmacists for recommended laboratory monitoring: 79.1 percent of dispensings in the intervention group were monitored compared with 70.2 percent in the usual-care group ( $p < .001$ ).<sup>14</sup>

Asynchronous alerts have been shown to influence positive provider behavior, such as improved appropriate response to abnormal labs. In one study,<sup>15</sup> alerts were sent to provider’s inboxes as abnormal labs were uploaded to the EMR. Appropriate ordering was significantly greater in the intervention study group at both 1 hour and at 24 hours.

**Source of Data for the Measure:** Electronic Data Repository; CPOE Usage Logs; Medical Records



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## Methodology for Measurement

### *Study Design 1: Measurement Over Time as Percentages*

Evaluators should first determine a start date and then regular intervals to track over time (e.g., weekly, monthly, and quarterly).

### *Analysis Considerations*

- If the system will allow, consider first turning the rules on in the background without displaying any message to providers during the preimplementation period. While rules are processing in the background, the provider will not receive any alerts recommending changes in their orders, but the system will be able to capture the number of alerts that would have fired and provider action. An alert that never fires may not be well-designed; an alert that fires with high frequency will likely become a nuisance and may prove to be ineffective. Baseline prealert ordering behavior could be compared to ordering behavior once alerts are implemented.
- The number of recommended actions could be the stopping of the ordered medication because of the alert (thus, decrease in rate is good) or ordering the test because of the alert (thus, increase in rate is good)
  - Pre-rate = (# of recommended actions in baseline period/total number of alerts in baseline period)
  - Postrate = (# of recommended actions in intervention period/total number of alerts in intervention period)
- Evaluators should consider how they will analyze multiple reminders for the same item. One option is to consider compliance to be whether the alert is ever acted upon rather than

counting each individual firing for the same provider/same alert.

- Using graphics is an effective way to present the results.

### *Study Design 2: Randomized Controlled Trial*

Randomize providers to intervention (those using health IT) or control (those not using health IT). If the organization has more than one site, evaluators could also randomize sites to intervention or control. Evaluators should define their intervention time period (e.g., number of months) based on feasibility and sampling size.

### *Analysis Considerations*

- Comparing the rates of rule-associated laboratory tests or the recommended care for intervention versus control groups to provide a measure of the efficacy of the intervention. For alerts that aim to reduce the ordering of potentially harmful medications, consider comparing the proportion of at least one dose in the control versus the intervention group.
- Allowing alerts to trigger for both the intervention and control groups, but preventing the alerts from being displayed to control group users (i.e., rules processing in the background, but not displayed as computer tracks alerts and provider action). This approach will enable you to control for those providers that would have completed the recommended action without the prompt or reminder.
  - Control Rate = (# of recommended actions completed in control group/total number of alerts in control group)
  - Intervention Rate = (# of recommended actions completed in intervention group/total number of alerts in intervention group)



- There may be an ethical consideration in withholding alerts/reminders from a control group; consider this prior to deciding on your study design.
- Consider the level of analysis for the control and intervention groups, i.e., are you comparing patients, providers, or sites? A reasonable approach would be to randomize by practice and analyze at the provider level.

### *Additional Considerations*

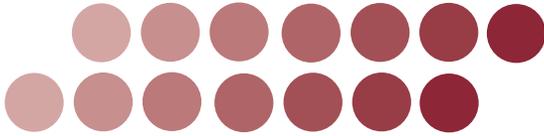
With this measure, the definition of what is meant by recommended action must be considered to decrease potential errors. Several issues should be addressed before proceeding with a statistical plan:

1. For each alert or reminder that is being implemented, your analysis plan should address what is meant by a recommended action, i.e., when credit should be given for a completed action. This consideration could include the duration of followup and how long evaluators should “wait” to see if the action was taken.
2. The evaluation plan should also address potential clinically acceptable alternatives that may not be accounted for by the alert. They can be difficult to detect, especially if the right domain expertise is not present.
3. Any manual chart review is resource intensive in terms of space, time, and costs. Whether these resources are available should be considered before undertaking any manual chart review.
4. If resources are limited, one option is to calculate and report descriptive statistics, such as percentages. Such information can give valuable insight to your team and your stakeholders and would avoid the difficulty in conducting and interpreting statistical tests.

5. Your data collection and analysis plan should be based on sound methodology. To achieve valid, robust results, consider planning your analysis with the input of a trained statistician to determine sample size and appropriate statistical techniques. It is not uncommon to begin analyzing data, only to find the original statistical plan was flawed, leaving you with data that is inadequate for analysis.

**Relative Cost:** Low: if data on the number of alerts and reminders and whether they are followed or ignored are captured electronically, although additional resources may be needed to monitor the control group. Costs will be higher if the evaluation requires manual chart review.

**Potential Risks:** It is important to assess and monitor the quality of data used to trigger the alerts and reminders as well as to ensure the correct numerator and denominator being used in the evaluation. There are many valid reasons why a provider may override an alert and the computer may not recognize or categorize it as an appropriate action.<sup>16 18</sup> Often an override reason is required. If an appropriate reason is not available to choose or enter in free text, or if the system does not require an override reason, then the data will not reflect appropriate overrides by the clinicians. For example, a drug-drug interaction alert may not be relevant if the patient is not currently taking one of the interacting medications on their active medication history list or a flu vaccination reminder may be ignored if a patient informs his/her provider they recently received vaccination at their local drugstore. If these valid reasons are not accounted for in the methodology (or used to refine the system), then the effect of the alert or reminder will appear to be reduced.



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