

## THE IMPACT OF READING ON PHYSICIANS' NONADHERENCE TO RECOMMENDED STANDARDS OF MEDICAL CARE

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**Abstract**—In order to increase physicians' adherence to recommended standards of medical care and to examine factors presumed to contribute to such changes, we conducted a randomized, controlled trial using reading materials targeted to specific practice recommendations. Seventy-nine internal medicine residents completed baseline questionnaires stating their intentions to follow 13 common preventive care actions. They were randomly assigned to receive one of two different sets of readings covering these care actions. Thus, each physician was in the experimental group for one set of readings (A or B) while serving as a control for the other set. The impact of the reading was determined by: the physicians' knowledge of the recommended care actions detailed in the combined readings, their post-reading intentions, and clinical behavior when faced with patients having indications for the recommended actions.

The 73 residents (92%) who read the material judged 39% of the information to be new and 72% useful. Residents had significantly better performance on the knowledge questions based on their own readings than did their control group peers for both sets of readings. For the Group A physicians, reading significantly ( $P < 0.05$ ) increased intentions to follow one of the seven clinical actions while Group B residents increased their intentions in three out of six.

Step-wise multiple regression analyses were used to predict physicians' post-reading adherence to the recommended actions. For the Group A actions, pre-reading actions accounted for most of the variance in their post-reading actions. Adherence to the Group B recommended actions was a function of an interaction between the physicians' baseline actions and access to the appropriate readings. Thus, the overall effect of this educational intervention was modest at best, and physicians who tended to follow the recommended actions more frequently than their peers before the reading became even more adherent after having read their materials.

Frequently, physicians do not follow recommended standards of care [1-6]. Explanations offered for this finding emphasize sociological [7], educational [8] and organizational [4] factors. Information from social psychology [9] suggests that physicians' actions are a direct function of their intentions to engage in the recommended action. Thus, unless there are barriers in the practice environment, physicians' intentions should be good predictors of their clinical actions. Educational efforts to enhance physicians' knowledge of better care should affect physicians' actions only indirectly, i.e. by changing their intentions.

In an attempt to increase compliance with preventive care protocols, we randomly assigned action-oriented reading materials to physicians in a general medicine clinic. Before and after the reading, we assessed physicians' (1) knowledge of the recommended care actions; (2) intentions to engage in the recommended actions for a variety of indications; and (3) clinical behavior when faced with patients having the indications for the recommended actions. Thus, the study not only attempted to increase physicians' compliance with recommended care protocols, but also to identify the variables contributing to those changes in compliance.

### METHODS

#### *Study subjects*

The subjects were residents in their second and third post-graduate years in the Internal Medicine Residency Program at the Indiana University School of Medicine. They practised in the general medicine clinic of a city/county, teaching hospital. Each house officer attended Medicine Clinic one half-day per week throughout his/her residency and delivered primary care to an assigned panel of patients. The clinic was divided into 32 teams, each consisting of one faculty physician from the Division of General Internal Medicine, two or three house officers, a registered nurse, a nurses' aide and a secretary/receptionist.

#### *Clinical actions studied*

Table 1 lists the clinical actions that were subject matter for this study. The criteria for selecting these actions were: (1) based on previous investigations [6], physicians employed these actions in less than 50% of the patients thought to be eligible; (2) there were a large number of patients eligible for each intervention; and (3) there were empirical data published in the literature to support the usage of the clinical actions, i.e. something to tell them about in the reading.

Table 1. Actions selected for Group A and Group B reading

|                                                | Group A                                                                       | Group B                                                                                  |
|------------------------------------------------|-------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|
| High intention<br>low/medium performance       | 1 Fecal occult blood test<br>(cancer screening and<br>work-up of anemia)      | Cervical cytology<br>smear<br>(cancer screening)                                         |
|                                                | 2 Pneumococcal vaccine<br>(prevention of<br>pneumococcal infection)           |                                                                                          |
| Low/medium intention<br>low/medium performance | 3 PPD skin test<br>(detection of TB in<br>demographically high<br>risk group) | Mammography<br>(breast cancer<br>screening for women<br>over age 50)                     |
|                                                | 4 Antacid<br>(prophylaxis against<br>ulcer and GI bleeding,<br>etc.)          | Cardiac glycosides<br>(treatment for<br>cardiomegaly and<br>DOE or stronger<br>findings) |
| Low intention<br>low performance               | 5 Beta blockers<br>(prophylaxis post-<br>myocardial infarction)               | Metronidazole<br>(treatment for<br>trichomonas)                                          |
|                                                | 6 Long-acting nitrates<br>(prophylaxis against<br>ischemic pain)              | Salicylates<br>(prophylaxis<br>against cerebral<br>ischemia)                             |
|                                                | 7 Antidepressants<br>(treatment for<br>depression)                            | Calcium supplement<br>(prophylaxis<br>against osteopenia<br>in postmenopausal<br>women)  |

On the basis of physicians' responses in previous studies [6], we stratified these actions into three categories: (1) those for which physicians had high intentions but low to medium performance; (2) those for which physicians had low to medium intentions and low to medium performance; and (3) those for which physicians had low intentions and low performance. We randomly assigned actions from each category to form Groups A and B (Table 1).

#### Experimental Intervention

The experimental intervention in this study was the provision of reading about specific clinical actions. Physicians were provided reading material concerning either the A or the B actions. Thus, there were actually two simultaneous studies with each group acting as control for the other. To prevent cross-contamination by adjacent physicians, we randomly assigned physicians by their clinic teams to receive either Group A or B readings. The residents were rewarded for participating by receiving credit at the university book store after completing the reading.

#### Reading material

Physicians were asked to read eight or nine pages of text about each clinical action in their own group. For many actions, the body of this text was excerpted from *Action-Oriented Decisions in Ambulatory Medicine* [10] which provided the rationale for specific actions given certain clinical indications and a literature review justifying this recommendation. For two actions (the use of antidepressants and metronidazole), the body of the text came from published review articles [11–13]. The total reading for each group was 62–69 pages including references. We estimated that the material could be read thoughtfully in four hours or less.

Following the reading on each action was a page containing two questions: (1) what percentage of the

material was perceived as useful in practice; and (2) what percentage represented new information to the reader. Since these questions were interspersed in the reading, they were used not only to estimate the physicians' perceived value of the reading material, but also to determine unobtrusively whether physicians actually read the materials. (All physicians who returned the material answered all of these questions.)

#### Time sequence of measurements and intervention

For most of the house officers, we observed their clinical behavior for 6 months prior to distributing the reading material and for 6 months afterwards. An exception was the 24 third year residents who left the clinic 3 months after the study began and for whom we have only three full months of clinical data post-reading.

Within 2–4 weeks after completing the reading, physicians took a knowledge test covering material from both A and B readings. The test was validated on medicine residents who departed prior to the current investigation. The questions had positive discrimination indices (i.e. people who answered a question correctly did better on the entire test than people who missed that question). The percentage of correct responses per question ranged 20 to 80. The resulting test was reviewed and approved by faculty physicians in the Division of General Internal Medicine. The final version consisted of 44 questions, with each reading topic being covered by at least 3 questions. Physicians were given the test while in the clinic and completed it during that clinic session or the next. We computed separate scores for each physician for the Group A and B questions.

To determine physicians' intentions to engage in the recommended clinical actions, we asked them to complete a questionnaire stating how often they employed each action for all relevant clinical indi-

cations. Although distractors not relevant to the reading material were included, the intentions score included only the physicians' responses to relevant items. Responses were coded on a 1 (Not At All) to 5 (Always) scale (see footnote, Table 3). High scores represented high usage of the action for an indication. Scores for each preventive care action were standardized by dividing the total score by the number of relevant items for that action.

To determine the stability of the intentions measure, we computed the correlation between the pre-intervention (Time 1) and the post-intervention (Time 2) responses for each control group (the responses to indications about which they did not read). Using paired *t*-tests, we measured the effect of the reading on the intentions score by comparing Time 1 and Time 2 responses to material about which physicians did read.

We used our computerized medical record system to monitor physicians' adherence to the standards of care for each of the A and B actions. The medical record system contained clinical, laboratory and hospital utilization data for more than 60,000 patients at the time of this study [6]. The computer noted whether or not a physician took a recommended course of action 6 months before and after the reading intervention when the indications for that action were present for one of his or her patients. Post-reading clinical behavior was 3 months for those 24 residents who graduated in July, 1982 and 6 months for all others.

For each patient cared for by one of the study physicians, we determined whether he or she was eligible for a particular action and, if so, whether that action was taken during the observation periods. For each action before and after the intervention, we computed the rate of adherence for the Group A physicians and the Group B physicians. If individual patients returned more than once during either observation period and were eligible for the same action on repeated visits, we collapsed each recurring eligible condition into one and counted any compliance as compliance with that one indication. Compliance occurred when a physician ordered an action for whom it was indicated.

Table 2. The influence of reading upon knowledge of residents, means and (SD)

|         | Group A residents | Group B residents | P value* |
|---------|-------------------|-------------------|----------|
| A Score | 14.03 (2.54)      | 12.41 (1.86)      | <0.001   |
| B Score | 10.84 (1.69)      | 12.97 (2.23)      | <0.001   |

\*One-tailed probability.

### Statistical analysis

We compared within-subject measurements from Time 1 to Time 2 using paired *t*-tests and mean measurements between Groups A and B using two-tailed *t*-tests. We then examined the relationship among the variables using simple correlations and multiple regression analysis.

## RESULTS

### Number of participants

At the start of the study, 85 house officers were candidates for participation. All physicians agreed to participate and were given the pre-reading questionnaires. Seventy-nine of the 85 residents (93%) returned the baseline intentions questionnaire. Seventy-three residents (86%) completed the reading. The analysis of the effect of reading intervention on knowledge, behavior and intentions was limited to the 73 physicians who actually read the material.

### Physicians' opinions about reading material

All physicians who completed and returned the reading material answered all of the questions about the newness and usefulness of the reading. Overall, the housestaff judged 39% of the information to be new and 72% to be useful. The percent new material per subject area ranged from 7% to 66% and the percent useful ranged from 19% to 100%.

More than half of the physicians invested time in underlining the material and writing marginal notes as they read it. A similar proportion asked us to return the material at the end of the study. The Group B residents saw their readings as significantly more useful than did the Group A residents (77% vs 67%,  $P < 0.05$ ).

Table 3. Effect of reading on intentions comparison of response at Time 1 with response at Time 2

|                            | Mean (SD)<br>indications<br>score*<br>Time 1 | Mean (SD)<br>indications<br>score*<br>Time 2 | P value |
|----------------------------|----------------------------------------------|----------------------------------------------|---------|
| <i>Group A (N = 32)</i>    |                                              |                                              |         |
| Fecal occult blood test    | 4.21 (0.99)                                  | 4.36 (0.78)                                  | NS      |
| Pneumococcal vaccination   | 4.32 (0.47)                                  | 4.19 (0.55)                                  | NS      |
| TB skin tests              | 4.04 (0.58)                                  | 4.20 (0.60)                                  | NS      |
| Antacids                   | 3.65 (0.70)                                  | 3.72 (0.66)                                  | NS      |
| Long-acting nitrates       | 3.45 (0.76)                                  | 3.48 (0.79)                                  | NS      |
| Beta blockers              | 3.36 (0.71)                                  | 3.75 (0.70)                                  | <0.05   |
| Tricyclic antidepressants  | 2.97 (0.55)                                  | 3.19 (0.55)                                  | NS      |
| <i>Group B (N = 31)</i>    |                                              |                                              |         |
| Metronidazole              | 4.50 (0.57)                                  | 4.44 (0.51)                                  | NS      |
| Digitalis                  | 4.26 (0.58)                                  | 4.60 (0.40)                                  | <0.01   |
| Cervical cytology smear    | 3.96 (0.68)                                  | 3.80 (0.56)                                  | NS      |
| Salicylates                | 3.98 (0.71)                                  | 4.13 (0.67)                                  | NS      |
| Mammography                | 2.94 (0.98)                                  | 3.53 (0.95)                                  | <0.01   |
| Calcium low dose vitamin D | 2.53 (0.81)                                  | 3.02 (0.71)                                  | <0.001  |

\*1—never (0–5%); 2—rarely (6–35%); 3—sometimes (36–65%); 4—usually (66–95%); 5—always (96–100%).

Table 4. Correlation coefficients among Group A actions: knowledge score, pre-reading intentions, post-reading intentions, pre-reading clinical actions and post-reading actions

|                | Knowledge | Pre-intention | Post-intention | Pre-action | Post-action |
|----------------|-----------|---------------|----------------|------------|-------------|
| Knowledge      | 1.00      |               |                |            |             |
| Pre-intention  | -0.10     | 1.00          |                |            |             |
| Post-intention | 0.11      | 0.58*         | 1.00           |            |             |
| Pre-action     | -0.09     | 0.13          | 0.08           | 1.00       |             |
| Post-action    | 0.08      | -0.01         | 0.00           | 0.49*      | 1.00        |

\* $P < 0.001$ .

Because of the small number of test questions about each clinical action, we combined the scores for all A questions and all B questions. Both A and B residents scored significantly higher on their respective knowledge tests than did controls (Table 2).

### Intentions

The physicians completed their intentions questionnaire prior to the reading (Time 1), and at the end of the post-reading observation period (Time 2). Overall, comparisons of study Group A with study Group B showed no significant differences for indications in any of the actions at baseline.

We found significant correlations ( $P < 0.01$ ) between Time 1 and Time 2 scores for 8 of the 13 actions in the control state. This indicates that the physicians' answers tended to be stable over a 3–6 month period of time.

To determine the effect of reading on physician intentions to perform the preventive care actions, we compared the intention scores of Group A physicians to perform Group A actions at Time 1 with their comparable scores at Time 2. We did the same with Group B physicians (Table 3). For the Group A physicians, intentions increased significantly only for use of the beta blockers. For the Group B physicians, reading about B actions significantly increased intentions for three of the six actions: mammography, use of digitalis and oral calcium supplements.

Of note were the high intentions to perform most of the actions: at baseline 11 of the 13 actions had intention scores of 3 or greater (a score of 3 means intending to perform the action in 36–65% of the times indicated) and 6 had scores over 4. At Time 2, all but 2 intention scores in both groups were greater than 3.5.

### Clinical performance/compliance

Over the 6 month duration of the study, the residents cared for 6279 patients who were eligible for one or more of the preventive care actions. Compliance with the protocols was low: for both groups, the recommended actions were complied with less than 10% of the times they were indicated.

The major goal of our study was to understand what factors contributed to variance in physicians' adherence to recommended clinical actions. We first calculated the correlation coefficients among knowledge, pre-reading intentions, post-reading intentions, pre-reading clinical actions and post-reading clinical actions for the Group A actions (Table 4) and for the Group B actions (Table 5). For both A and B actions, intentions prior to reading correlated significantly ( $P < 0.001$ ) with post-reading intentions. Similar findings were shown for the relationship between clinical actions prior to and after the readings. However, no significant relationships were found between knowledge and intentions, nor between intentions and actions. For the Group A residents, score on the Group A questions on the knowledge test did not correlate with any other measure, whereas for the Group B residents' knowledge correlated only with post-intervention actions ( $P < 0.05$ ).

In addition to the above analyses, we also performed a series of step-wise multiple regressions analyses using the clinical actions as the criteria and the above variables as the predictors. To see the effect on specific actions, we performed these multiple regression analyses for the two actions in each group that were indicated with the highest frequency (Group A: pneumococcal vaccine and occult blood testing; Group B: mammography and cervical cytology and the combined Group A and B actions). There were a number of actions for which more than half of the physicians did not have at least five patients eligible for that action. In such instances a number of physicians had either no or one eligible patient. Determining their percentage of adherence to the recommended clinical action with such low prevalences did not seem appropriate since the percentages might not be as stable as estimates of adherence based on more frequently occurring actions. Therefore, we did not perform multiple regression analyses for actions with low prevalence. The results of the step-wise multiple regression analyses are shown in Table 6. Only significant predictors and their beta weights are listed.

Physicians' compliance prior to the reading accounted for significant post-intervention actions for

Table 5. Correlation coefficients among Group B actions: knowledge score, pre-reading intentions, post-reading intentions, pre-reading clinical actions and post-reading actions

|                | Knowledge | Pre-intention | Post-intention | Pre-action | Post-action |
|----------------|-----------|---------------|----------------|------------|-------------|
| Knowledge      | 1.00      |               |                |            |             |
| Pre-intention  | 0.05      | 1.00          |                |            |             |
| Post-intention | -0.03     | 0.54†         | 1.00           |            |             |
| Pre-action     | 0.12      | 0.05          | 0.13           | 1.00       |             |
| Post-action    | 0.23*     | -0.02         | 0.14           | 0.27*      | 1.00        |

\* $P < 0.05$ ; † $P < 0.001$ .

Table 6. Predictors of residents' post-intervention clinical actions: results of step-wise multiple regression analyses

| Predictors                                   | Actions                                                   |                                                         |                                                     |                                                  |                                             |                                             |
|----------------------------------------------|-----------------------------------------------------------|---------------------------------------------------------|-----------------------------------------------------|--------------------------------------------------|---------------------------------------------|---------------------------------------------|
|                                              | Pneumococcal vaccine (A)<br>$R^2 = 0.48\%$<br>beta weight | Fecal occult blood (A)<br>$R^2 = 0.35\%$<br>beta weight | Cervical smear (B)<br>$R^2 = 0.06^*$<br>beta weight | Mammography (B)<br>$R^2 = 0.41\%$<br>beta weight | A combined<br>$R^2 = 0.38\%$<br>beta weight | B combined<br>$R^2 = 0.41\%$<br>beta weight |
| Baseline action                              | 0.53§                                                     |                                                         |                                                     |                                                  | 0.43§                                       |                                             |
| Baseline action by group interaction         | -0.26§                                                    | 0.27§                                                   | 0.14*                                               | 0.41§                                            |                                             | 0.24‡                                       |
| Year of training (departing = 1, others = 0) | -0.02*                                                    | -0.06†                                                  |                                                     |                                                  | -0.04‡                                      | -0.04§                                      |

\* $P < 0.05$ ; † $P < 0.01$ ; ‡ $P < 0.001$ ; § $P < 0.0001$ .

Note: variables included in the multiple regression analysis which were not significantly predictive included: knowledge test A score, knowledge test B score, pre-intervention intention score for each action and their combined scores, post-intervention intention score for each action and their combined scores, physician's study group status (Group A to B). All values are the beta weights for each predictor.

using pneumococcal vaccination and for the combined A actions. The most consistent predictor of physician compliance was the interaction between their reading group status and their pre-reading level of compliance. For pneumococcal vaccine, cervical cytology, mammography and the combined B actions, physicians who at baseline tended to engage in those actions more frequently than their peers became even more adherent to the recommended actions after the appropriate readings. Inexplicably, the significant ( $P < 0.0001$ ) baseline by study group interaction for occult blood (an A group reading) resulted from the improved performance of the B groups physicians relative to the A group physicians.

For pneumococcal vaccination, occult blood, and combined A and B actions, there was an effect of the residents' year of training: departing residents performed the actions less frequently than did residents who remained. However, departing third year residents had only 3 months during they could comply, compared with 6 months in the second year residents.

Most of the factors listed in Tables 4 and 5 were unable to account for differences in physicians' actions. The exception occurred for the combined B action multiple regression analyses. Both performance on the B knowledge test items ( $P = 0.004$ ) and the B pre-reading intention scores ( $P = 0.005$ ) contributed a small, but statistically significant, amount ( $P < 0.05$ ) to the regression equation.

## DISCUSSION

Of interest in our study was the failure of a specifically targeted educational intervention to alter physicians' preventive care behavior and the frequent discrepancy between physicians' intentions and their actions. Only for the Group B actions was there a small but significant relationship between intentions and actions. Some mismatch should occur because there are barriers in all clinical settings which prevent physicians from accomplishing everything they would like to do. Moreover, physicians' judgments of their own behavior can be poorly calibrated, especially when there is no corrective feedback mechanism to identify the discrepancy between one's actions and intentions. In a recent study, we have shown that physicians' intentions correlated significantly with their clinical actions only when there were reminders attached to the patients' charts to identify patients eligible for a particular clinical action [6]. The enormous

array of information with which physicians must cope may conceal the information necessary for acting on their intentions.

Both the A and B readings had significant effects on residents' knowledge. If this knowledge were to affect clinical behavior, it should do so by changing physicians' intentions. There was evidence that this occurred in the A residents for one of seven actions and B residents for three of the six actions.

In our multiple regression analyses, we found an effect of the Group B reading on the performance of pneumococcal vaccinations, cervical cytology smears, mammography and combined B actions. However, this effect was seen only when interacting with the physicians' compliance during the 6 months prior to the study. Thus, physicians who were more compliant before the study were encouraged to comply more, while reticent physicians remained so.

Journal reading is the method preferred by physicians for improving their practices [14-18], and in the United States continuing medical education is a multi-billion dollar industry [19]. We would like to believe that physicians who update their knowledge about recommended standards of care, and the evidence that supports those recommendations, are more likely to transfer that knowledge into practice. The results of the current study indicate that, while such a relationship exists, it is not straight-forward, and its magnitude is small.

Our data emphasize the need for mechanisms to increase compliance with preventive care protocols. The overall compliance rate in eligible patients was less than 10%, in spite of post-reading intention scores of  $>3$  (indicating planned use of the actions in 36-65% of the eligible patients) for all of the actions and scores greater than 4 ( $>65\%$  intended compliance) for 7 of the 13 actions we studied. Our previous work has shown an effect of computer-generated reminders in increasing compliance with a broad range of preventive care protocols, including all of those in the present study [6]. Those results far out-distanced the results of the current study. This suggests that barriers to preventive care are formidable and most likely logistic (organizational) rather than educational or attitudinal.

In conclusion, our study has shown that readings targeted to specific practice recommendations can result in measurable increases in knowledge and, to a lesser extent, intentions. Although we demonstrated an increase in compliance with some of the targeted

preventive care protocols following an educational intervention, the educational material seemed to offer the most benefit to those physicians who needed it least.

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