

# A Controlled Trial to Improve Delivery of Preventive Care:

## Physician or Patient Reminders?

BARBARA J. TURNER, MD, MEd, SUSAN C. DAY, MD, MPH,  
BETTE BORENSTEIN, PhD

**Objective:** *To improve the delivery of preventive care in a medical clinic, a controlled trial was conducted of two interventions that were expected to influence delivery of preventive services differently, depending on level of initiative required of the physician or patient to complete a service.*

**Design:** *A prospective, controlled trial of five-months' duration.*

**Setting:** *A university hospital-based, general medical clinic.*

**Participants:** *Thirty-nine junior and senior medical residents who saw patients in stable clinic teams throughout the study.*

**Intervention:** *A computerized reminder system for physicians and a patient questionnaire and educational handout on preventive care.*

**Measurements and main results:** *Delivery of five of six audited preventive services improved significantly after the interventions were introduced. The computerized reminder alone increased completion rates of services that relied primarily on physician initiative; the questionnaire alone increased completion rate of the service that depended more on patient compliance as well as on some physician-dependent services. Both interventions used together were slightly less effective in improving performance of physician-dependent services than the computerized reminder used alone.*

**Conclusions:** *These interventions can improve the delivery of preventive care but they differ in their impacts on physician and patient behaviors. Overall, the computer reminder was the more effective intervention.*

**Key words:** *Preventive care; computer reminder; patient questionnaire; medical clinic. J GEN INTERN MED 1989;4:403-409.*

DISEASE PREVENTION is the responsibility of both physicians and patients. To maintain a disease-screening program that meets standards set by panels of experts,<sup>1-3</sup> physicians must order or perform necessary preventive services at specific intervals and patients must comply. There is ample documentation to show that many preventive services are not performed and that recommended standards are not being met,<sup>4-7</sup> perhaps be-

cause most efforts to improve the delivery of preventive care have focused on either physicians or patients, but rarely both.

We report the results of introducing two interventions that involved both physicians and patients in the effort to improve the frequency with which preventive services were performed in a university hospital-based general medical clinic. The project was initiated after a chart review documented deficiencies in the delivery of preventive care by housestaff and faculty in our medical clinic. The performance of the audited preventive services for 302 patients ranged from less than 10% completion rates for mammograms and tetanus immunizations to approximately 40% for breast and rectal examinations. Performance rates were no better among physicians at advanced levels of training.<sup>8</sup> Therefore, our educational program on preventive care appeared not to improve delivery of services by housestaff or faculty even after many had been exposed to it several times. To supplement our educational program, we introduced, in a prospective controlled trial, a computer record/reminder system targeted at physicians, and a questionnaire about current preventive care status designed for and targeted to patients. An educational handout on preventive tests and services accompanied the questionnaire.

To monitor the impacts of these interventions, six preventive services were selected. Each requires different degrees of physician and patient initiative to complete. Breast and rectal examinations require greater physician and less patient initiative. The degrees of physician and patient initiative required for Pap smears and stool guaiac tests for occult blood depend on whether the primary care physician performs the test, refers the patient to another physician for the test (Pap smear), or asks the patient to complete the test at home (guaiac test). Mammography may require less physician and more patient initiative because the physician simply orders the test, but the patient has to be motivated to report at another time for it. Tetanus immunizations are usually performed by non-physicians in our clinic, demanding less effort from both physician and patient.

This study was designed to test the hypothesis that two preventive care improvement interventions, the computer record/reminder for physicians and the preventive status questionnaire for patients, would influence the performance rate of preventive services disproportionately according to the initiative required of

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Address correspondence and reprint requests to Dr. Turner: Center for Research in Medical Education and Health Care, 132 College Building, 1025 Walnut Street, Philadelphia, PA 19107.

TABLE 1

Illustration of Selected Data on the Computerized Record and Reminder System for a Sample 77-year-old Male Patient (Date of Visit: 9/15/87)

Status*	Description	Frequency (Years)	Last Done (Day/Month/Year)	Due†
Service completed	Blood pressure	01Y†	150587	
	Stool guaiac	01Y	120686	*
Service completed	Rectal exam	01Y	150587	
Service requested	Vision/glaucoma	01Y		*
	Tetanus/diphtheria	10Y	010175	*
	Influenza	01Y	010983	*
	Pneumovax	99Y‡		*

\*Indicated by resident during visit.

†Minimum frequency recommended.

‡Required once in a lifetime.

§Indicator (\*) appearing on chart when intervention is due.

the physician or patient to complete the task. The computer reminder was expected to have a greater influence on the performance of tests requiring physician initiative, and the questionnaire was expected to motivate more patients to have mammography. The greatest overall improvement in the delivery of preventive care, however, was expected to result when both reminder interventions were used simultaneously.

## METHODS

### Study Setting

The study was conducted from January through June 1984 at a general medicine clinic of a university hospital. There were five medical clinic teams, each comprising housestaff, two attendings, and a social worker. The same nurse practitioner was involved in all five team efforts. Each team attended clinic on a specific day of the week over the entire period of the study. Only junior and senior residents were included in the study because they had developed stable panels of their own patients. Over the course of a year, approximately 12,000 patient visits were made to the 75 residents in the clinic. In general, patients came from an inner city, indigent population for care of multiple chronic illnesses.

### Data Collection

One or two patient charts were selected at random from each physician's clinic session, and this audit was repeated for two to six clinic sessions for each resident. Chart abstractors were not blind to the clinic groups of the patients in the audit. To insure that physicians had the opportunity to complete needed preventive care services, each patient in the study had to have visited the study physician at least twice prior to the visit being audited. Most patients had been followed by the study physician for at least one year.

The six services selected for audit were tetanus immunization, Pap smear, guaiac test, mammography, breast examination, and rectal examination. Standards

were set for the performance of each of the services using guidelines established by the Canadian Task Force (CTF),<sup>3</sup> except that yearly breast examinations for women over 50 and yearly rectal examinations for all patients over 40 years old were required.<sup>1, 2</sup> Test performances had to be recorded in the chart. Data were also collected regarding the type of physician completing the test (i.e., primary physician, another medical clinic physician, or a consultant in another clinic) and his/her level of training.

Performance of the preventive services was monitored only for patients eligible for each particular test. To be eligible, a patient had to be of the appropriate age and sex, and free of any pre-existing disease that required monitoring by one of the specified services (available from the authors). The presence or absence of chronic illness, defined as having one or more serious chronic diseases or one or more recent hospitalizations, was noted. Patient age, sex, type of payment, number of clinic visits, duration of care (in months) rendered by the primary provider, visits to other clinics, and diagnoses also were recorded. Chart audits revealed preventive care delivery beginning with the patient's first visit to the housestaff provider through his or her last visit. Auditors noted whether a service was complete (recorded within the interval recommended by expert guidelines) or incomplete (either previously recorded but needed again, or never done). Physicians were unaware of the audit and no new educational programs on preventive care were introduced during the audit.

### Study Interventions

The computer record/reminder system, as shown in Table 1, used age- and sex-standardized criteria for preventive care to generate a patient-specific reminder that was printed at the bottom of each patient's visit record sheet. Physicians were instructed to write in the date on which each listed service was last completed (C) or requested (R). On subsequent visits, the computer printed the updated information on the visit

record; an asterisk in the "due" column indicated that it was time to repeat the service. Five medical clinic attendings pilot-tested the system in the fall of 1983 before making it available to residents on specific clinic days.

Sex-specific patient questionnaires on the status of preventive care were developed for the study. The following is a sample question to which the patient answered yes or no: "Have you had a tetanus shot in the past ten years?" A handout describing the risks, benefits, and current recommendations for standard preventive services was developed by one of the authors (BJT), edited by a layperson, and distributed to the patients after they completed the questionnaire. The questionnaires were pilot-tested by 20 patients in the medical clinic and revised to make them easier for patients to complete. Two trained research assistants handed the questionnaires to patients who were waiting to see their physicians. Patients were instructed to complete the questionnaire in duplicate, keep the original, and give the carbon copy to their doctors during their visits. They were also advised to discuss any incomplete preventive care with their physicians.

### Study Population

Thirty-nine juniors and senior residents were in the study. These residents were included because their rotations permitted them to be in the clinic throughout the study. Charts of 253 patients, 20 years of age or older, were audited up to five months following the introduction of the reminder interventions. We audited a mean of 6.5 charts per physician (range 2–12), and only two residents had fewer than five charts audited.

Each reminder intervention was introduced on three consecutive days. Each intervention was used alone by two different clinic teams, and a combination of both interventions was used by one clinic team (Table 2).

### Test of Knowledge

A previously used 11-item test of residents' knowledge of preventive care<sup>9</sup> was administered one month

**TABLE 2**  
Assignment of Interventions

	Mon	Tues	Wed	Thurs	Fri
Type of Strategy*	C	C	C/Q	Q	Q
Number of residents audited	6	8	9	8	8

\*C = Computer record/reminder system, Q = questionnaire for patients.

before and five months after initiating the two reminder interventions.

### Data Analysis

Chi-square and one-way analyses of variance were used where appropriate to compare demographic and clinical characteristics of residents' patients in the three intervention groups (computer alone, questionnaire alone, or both).

The individual resident served as the unit of analysis to determine the impact of the interventions. Each resident's delivery of the preventive services after the intervention was compared with that before the intervention using the last pre-intervention visit and the first post-intervention visit. Although we compared the resident's performances for two visits only, in order to determine what tests were needed for completion at each point in time, a full record of the patient's preventive care was needed. For example, a stool guaiac (required yearly) might have been completed for an eligible woman in a visit ten months before the last pre-intervention visit and thus would not be needed again for another two months (complete). However, the test would have preceded the post-intervention visit by 14 months and would have been due (incomplete) at that time.

The mean percentages of each resident's eligible patients having tests performed according to time intervals set by experts for the pre- and post-intervention visits were compared using the Wilcoxon signed rank

**TABLE 3**  
Selected Profiles of Patients in the Three Intervention Groups

	Computer (n = 103)	Questionnaire (n = 86)	Computer/Questionnaire (n = 64)
Age (mean)	59.7 years	59.9 years	61.6 years
Female	74%	78%	69%
Number of serious diseases (mean)	2.1	1.9	2.0
Seriously ill*	73%	66%	79%
Treated by junior residents	40%	45%	51%
Covered by Medicaid	53%	51%	43%
Yearly visits (mean)	5.7	5.5	6.5
Duration of care by resident	15.0 months	13.7 months	13.3 months

\*One or more serious diseases or hospitalized in the past year.

test for matched pairs.<sup>10</sup> This analysis tested the change produced by each intervention. Since the services had different completion rates prior to the interventions, factorial analysis of covariance was performed to compare the relative impacts of these interventions controlling for the pre-intervention completion rates.<sup>11</sup> Finally, data were reanalyzed excluding outliers as well as those from the two residents who each had fewer than three patients audited, and no differences in results were found.

## RESULTS

### Patient Characteristics

Selected characteristics of clinic patients in the three intervention groups are shown in Table 3. No significant differences were found among the groups. In the computer/questionnaire group, slightly more yearly visits by patients had occurred.

### Performance of Preventive Care

The performances of five of the six services by participating residents are shown by intervention group, both before and after the introduction of interventions, in Figure 1. Tetanus immunization is not shown because no improvement in performance was noted, with the performance rate remaining at less than 10% despite the interventions. With the exception of the extremely poor performance of mammography by the residents in the computer/questionnaire group, no large differences were observed in the performances of the services before the interventions were initiated. Overall, the interventions produced highly significant improvements as determined by the Wilcoxon signed rank test in the performances of mammography ( $p = 0.004$ ), breast examination ( $p = 0.0002$ ), stool guaiac tests ( $p = 0.0006$ ), and rectal examination ( $p = 0.0001$ ). A less significant impact was found on the performance of Pap smears ( $p = 0.02$ ).

Figure 1 shows that the impacts on performances of the selected services varied by intervention group. The computer reminder alone produced significant improvements in the performance of breast and rectal examinations and stool guaiac tests as well as a trend toward greater frequency of performing Pap tests. These tests generally depend more upon physician initiative. The questionnaire used alone resulted in a significantly better performance of mammography, which relies primarily on patient motivation, as well as a better performance of several physician-initiated tests, including rectal and breast examinations. Using both reminders together resulted in improvements in the frequencies with which rectal examinations and guaiac tests were performed and a trend toward better rates of performing Pap tests. The only exceptions to these improvements were the very slight improvement noted in the performance of mammography in the computer re-

minder group and the combined intervention group, and the small decrease in Pap test performance in the questionnaire group.

Comparisons of the effects of the interventions using analysis of covariance, controlling for the percentage completed of each service prior to the intervention, showed no significant differences for four of five services (again excluding tetanus) in the improvements produced by each of the interventions. Only for mammography did the questionnaire alone show a much greater effect than did the questionnaire and computer reminder combined.

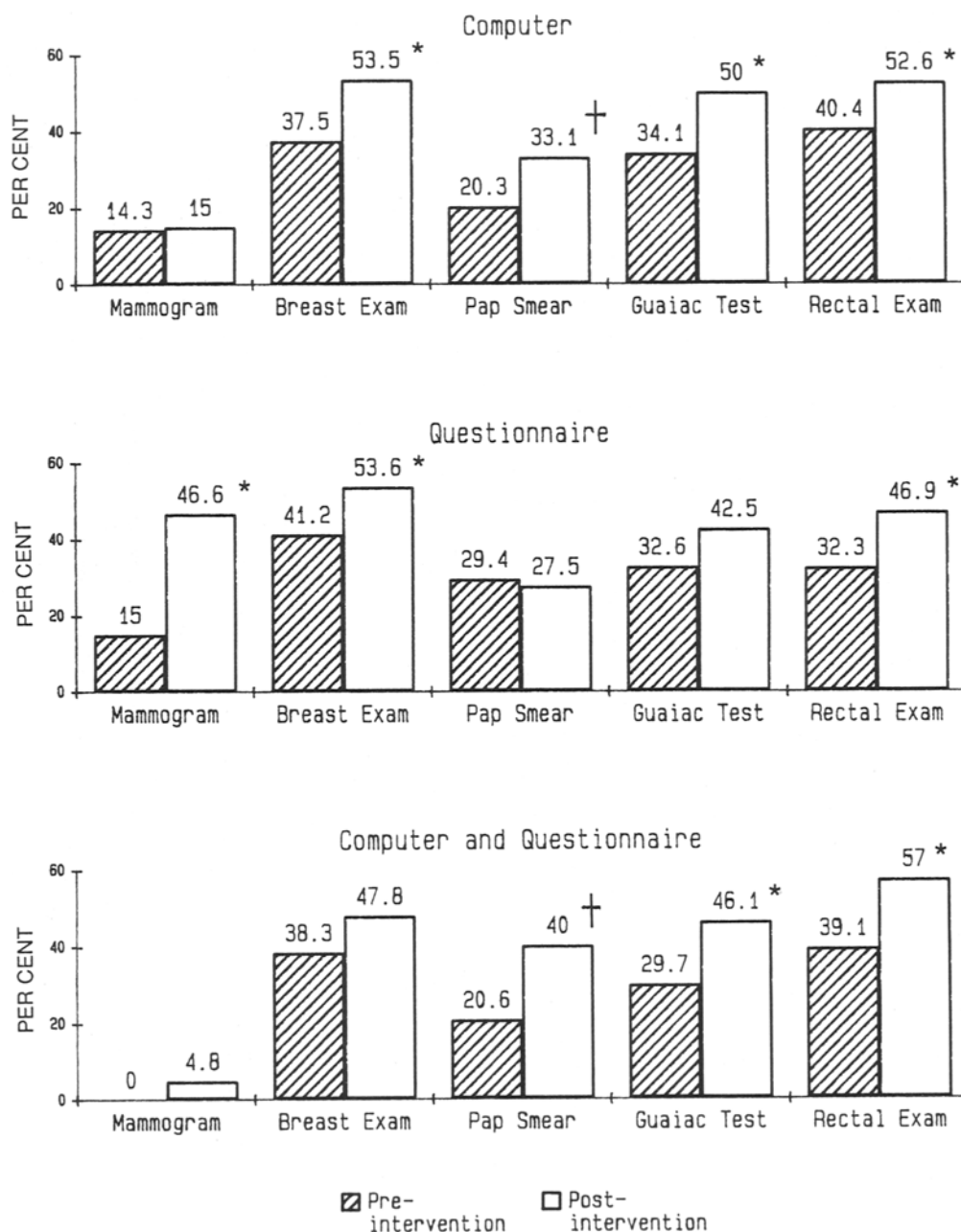
Patients who had been hospitalized in the preceding year ( $n = 32$ ) were no more likely to have had the preventive services done (according to data available in their clinic charts) than those who had not been. Performance of the audited services rendered in other clinics played a minor role in the rate of completion of any service. A Pap test was the service most commonly performed outside the medical clinic, but only five patients had Pap smears done in this way. The clinic's nurse practitioner was not involved in delivering preventive care to residents' patients.

### Test of Preventive Care Knowledge

All 39 residents completed the preventive care knowledge test just prior to the initiation of the interventions. Ten residents completed the test four months after the interventions were implemented. The mean score for all who completed the pretest was 7.6. The ten residents completing both pre- and posttests had mean scores of 7.4 and 9.2, respectively. All 39 residents took the test again at the end of the study. The mean score on the retake was 9.2. While scores tended to improve, the difference was not significant using the t-test for dependent groups ( $p > 0.05$ ).

### Long-term Impact of Computer Program

Because it may have taken some time for the residents to become accustomed to the computer reminder program, we examined the impact of this intervention on preventive care one year after the system was first introduced. The frequency with which all audited services were performed remained above the level observed prior to the introduction of the interventions. The percentages of completed services for all audited patients ( $n = 145$ ) ranged from 33% for the Pap test to 52% for the rectal examination. By contrast, before the introduction of any intervention, average performance rates ranged from 9% for mammography to 39% for a breast examination. The performance of tetanus immunizations improved from none to 6%. Therefore, the positive impact of the computer reminder and perhaps the patient questionnaire (from the year before) appears overall to have been sustained.



**FIGURE 1.** Comparison of performances of selected preventive services by study residents before and after introduction of each intervention. Results are mean percentages of completed tests for all residents in each intervention group. \* $p \leq 0.05$ , Wilcoxon signed rank test for matched pairs. † $p = 0.06$ , Wilcoxon signed rank test for matched pairs.

The frequency of breast examinations showed the greatest decline in the follow-up audit compared with the period immediately after the introduction of the interventions (from 52% to 45%), while the performance of mammography significantly increased (from 23% to 40%).

### DISCUSSION

Many studies have shown that without special adjuncts, the delivery of preventive care in medical clinics is inadequate.<sup>7, 9, 14-16</sup> A chart audit confirmed

that the university hospital-based medical clinic in this study was no exception. The preventive services audited prior to the study were performed less frequently than recommended by expert panels.

To address the problem, a controlled trial was conducted using two interventions designed to improve the delivery of preventive care. The interventions, one a computer record/reminder system and the other a patient questionnaire and handout that dealt with preventive health care status, were expected to affect the performances of selected preventive interventions differently. The computer system was expected to result

in a higher rate of completion of those preventive measures that must be performed by the primary care physician. The questionnaire was expected to produce, as in other studies, a higher compliance rate in tests that require additional time and effort on the part of the patient.<sup>17,18</sup>

Within five months of initiating the interventions, a significant increase was observed in the overall performances of five of six services. No improvement was noted in the performance of tetanus immunizations, perhaps because both physicians and patients believe it to have a low priority. The computer reminder system, when used alone, produced improvements in all the services except mammography. When the patient questionnaire was the only reminder used, there was improvement in the performance rate of mammography as well as the rates of breast and rectal examinations. The computer reminder and the questionnaire used together were slightly less effective than the computer reminder used alone. The combined tactics produced improvements in the performance of guaiac tests, rectal examinations, and Pap tests.

The failure of the questionnaire to improve mammography performance in the combined-strategy group is difficult to explain. Perhaps the use of both reminders at once provided too much information for the physician and patient. Mammography had an overall low rate of performance in our clinic and might have been deferred until other tests, deemed more important, were completed.

This trial confirmed that the performance of services that require physician initiative — the breast, rectal, and pelvic examinations — could be improved by a physician-oriented reminder system such as the computer reminder system. On the other hand, the patient questionnaire and educational material used alone had a greater impact on the frequency with which patients received mammography. Since patients must be motivated to follow through on a physician's recommendation for mammography, this finding suggests that preventive care may be best improved by targeting the individual who has the primary responsibility for complying with the recommended standard of care. We conclude, then, that the computer reminder program was the most effective of the interventions when used alone. However, the study suggests that a specific questionnaire and handout on mammography might be a useful supplement.

The limitations of the study should be considered when interpreting the results. The chart auditors were not blinded to the study groups from which the patients were drawn. The residents were not informed of the study; however, the very introduction of the interventions may have temporarily increased their performances of preventive care (Hawthorne effect). Our findings suggest such an effect, in that the delivery of some

services did not remain significantly improved when we performed the audit one year after the introduction of the strategies. A longer-term study would be necessary to determine whether this drop would continue or reverse.

Interestingly, breast examinations declined most in the follow-up audit while mammography performance increased substantially. It is possible that the residents mistakenly believed that mammography alone serves as a sufficient breast cancer detection method. Residents' preventive care knowledge was tested both before and after the introduction of the reminder strategies. There were no significant gains in test scores after several months of using reminder strategies. Thus, without specific educational programs, reminders might not produce wholly beneficial effects on the performance of preventive care. Yet educational programs alone, without methods that prompt physicians to perform required tests, have not produced improvement in performance of preventive care interventions.<sup>9, 12, 13</sup>

The percentages of patients with completed services are similar to and, in some cases, less than, those reported in other studies.<sup>9, 14-16</sup> Patient eligibility to participate in this study was reduced by excluding all patients for whom one of the selected services would be used for disease monitoring. This selectivity may have reduced the ability to detect differences in the frequencies with which services were performed before and after the introduction of the interventions.

The preventive care reminders used in this study can be applied easily in other medical clinic settings. Many clinics use computers to maintain billing records, and the computer record/reminder system developed for this study was produced by modifying our billing system to generate appropriate data on preventive care status on the visit record. The computer reminder system offers several advantages over a simple checklist in that the computer can automatically flag needed tests. The computer system can also be used to monitor a particular resident's delivery of preventive care to patients, and it can be tailored to specific patients' needs by deleting unnecessary tests or adding others.

Other studies have used patient questionnaires<sup>19</sup> or computer reminders,<sup>14</sup> but none have compared their effects. This study revealed that the two systems produced improvements in the deliveries of different preventive interventions. The computer reminder appeared to have the greatest overall impact, but the patient questionnaire was especially effective in increasing mammography performance. Our study indicates that different types of reminders may have to be developed to target physician and patient behaviors.

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## REFLECTIONS

Today nearly everyone is a specialist, which means that everyone is also a layman confronting ten thousand surrounding specialists.

JACQUES BARZUN

*A Word or Two Before You Go*

Middletown, CT, Wesleyan University Press, 1986