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ACQUISITION AND MAINTENANCE OF HEALTH-CARE ROUTINES AS A FUNCTION OF FEEDBACK DENSITY

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Two schedules of feedback were examined to determine their relative effects on the acquisition and maintenance of three health-care routines: feeding, positioning, and transferring physically disabled patients. Four direct service providers' performances in the natural environment were measured weekly. Concurrent schedules and multiple baselines across subjects and response classes were used to evaluate the effects of written instructions combined with either continuous, intermittent, or no-feedback schedules. Results showed that instructions alone led to slight and usually brief changes. Marked improvements were noted after feedback was introduced, with the continuous schedule producing more rapid acquisition. Follow-up measures indicated performance maintenance for both schedules. Subjects rated the feedback programs favorably and recommended provision of this service to co-workers. Cost estimates indicated that, although considerable time was spent developing the observational system, the feedback procedure was relatively inexpensive, easy to use, and did not interfere with patient care.

DESCRIPTORS: feedback, health, maintenance, safety, task analysis

According to the National Safety Council (1984), hospitals report more occupational injuries (3.71 lost work days per 100 full-time employees) than the average for American industries. Usually, unsafe work practices contribute to these accidents, and therefore, the promotion of safer work routines may prove effective in reducing injuries (cf. Geller, Lehman, & Kalsher, 1989; Sulzer-Azaroff, 1978).

Numerous studies have demonstrated that performance feedback can change many different classes of work practices among various workers in diverse settings (see Prue & Fairbank, 1981, for a review). Although this literature suggests the generality of feedback as an effective staff management procedure, relatively few studies have systematically compared different values of the critical parameters of feedback contingencies. The current research addressed one of these parameters—the schedule of administering the feedback.

Humans have generated unpredictable patterns of performance under different schedules of reinforcement. For example, a number of studies (e.g., Lowe, 1983; Mathews, Catania, & Shimoff, 1985; Weiner, 1983) have shown that under fixed-interval (FI) schedules some adults perform at sustained high rates and others perform at lower and more variable rates. To explain these individual differences, factors such as reinforcement history, verbal facility, and the presence of other concurrent schedules were entertained.

The schedules of reinforcement used during occupational training may influence both patterns of acquisition and the maintenance of posttraining performance. Ideally, safety training programs should rapidly establish durable safety practices, thereby minimizing workers' initial as well as subsequent exposure to hazards. An important agenda for experimental analysts of safety behavior is to determine how practical schedule variations may influence important dimensions of work performance.

When a response has been repeated over many years, it may be highly resistant to change. Providing the learner with immediate and consistent

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consequences is critical. Tosti and Jackson (1981), for example, argued that to change the form of a response, feedback should be provided only when the performer has the opportunity to try the new performance immediately. Several researchers have demonstrated successful interventions by providing continuous feedback to change such behaviors as nervous habits, tics, stuttering, and nail biting (Azrin & Nunn, 1973, 1974, 1976), safety belt use (Geller, 1983), and food preparation (Geller, Eason, Phillips, & Pierson, 1980). The data they have presented attest to the efficacy and practicality of massed feedback interventions (i.e., resembling continuous reinforcement (CRF) schedules).

Despite studies that demonstrate the practicality and effectiveness of continuous feedback schedules, the schedules most often used to modify work practices have tended to be intermittent—spaced over days, weeks, or months. For example, feedback has been delivered daily (Shook, Johnson, & Uhlman, 1978), biweekly (Sulzer-Azaroff & de Santamaria, 1980), and monthly (Sulzer-Azaroff, 1978). After acquisition, it often is necessary to gradually fade feedback delivery to promote maintenance of the new behavior. Spacing of feedback is understandable, because intensive observation and training are atypical and may seem intrusive and costly. Spacing may also help to explain why change often remains somewhat limited. Nevin (1988) reported that the persistence of responding in free operant situations is strongest following dense schedules of reinforcement. His findings indicate the need for further assessment of the common practice of fading reinforcement delivery to promote maintenance. If different methods of supplying training and feedback that included optimal schedules were identified, safety in the workplace might improve further.

By systematically examining the effects of dense and intermittent feedback schedules on the acquisition and maintenance of actual work behaviors, this study attempted to yield further information on how safety behavior can be changed and maintained. We compared an intermittent schedule, in which feedback was delivered weekly, with a nearly continuous schedule, in which feedback was provided after every one or two responses.

METHOD

Subjects

Employees (who gave written informed consent to participate) were 4 female direct-care workers in a medical services unit of a public residential facility for the mentally retarded. Their ages ranged from 28 to 38 years, and their experience in their current assignments ranged from 3 to 8 years. Because many of the care routines examined in this study were conducted in the evening, only second shift employees were involved. All had received periodic in-service training in the appropriate conduct of the three work routines examined in this study. However, prior to the study, 2 subjects had filed accident reports because of injuries incurred while lifting patients. Given their long work histories, the highly repetitive nature of their jobs, and the unchanging environment of an institutional work setting, each subject's work routines expressed at the start of this project were viewed as well-established patterns.

All of the patients served were severely or profoundly mentally retarded, multiply physically handicapped adults; all were nonambulatory. All were essentially nonverbal, and many suffered from serious physical ailments that required close nursing care. In general, the patients were heavily dependent upon direct-care and nursing staff for their life-sustaining services.

Setting

The experimental setting was a residential wing of an infirmary building that was home for 24 residents. It contained private as well as semiprivate sleeping areas, several bathrooms, and three community living rooms. The layout allowed the experimenter to provide feedback privately to each subject and allowed the research assistants to observe discretely each subject's work performance.

Observation Procedures

Selection of target behaviors. The strategy recommended by Sulzer-Azaroff and Fellner (1984) was used to identify unsafe work practices. Accident records collected over the 2 years preceding the study were reviewed to determine settings in which high rates of serious employee injuries occurred.

This review indicated that back injuries, incurred during the lifting, transfer, and positioning of physically disabled patients, were among the most severe. Back injuries are a widespread problem in nursing care, and patient handling is identified as a causative factor (Stobbe, Plummer, Jensen, & Attfield, 1988). The reported injuries occurred most frequently in the residential and program areas where physically disabled individuals lived and received treatment. Consequently, patient transferring and positioning were selected as target routines. A third routine, feeding, was also selected as a control measure. This activity was also conducted daily by the subjects at approximately the same frequency and in the same setting as the primary target behaviors. Variability among subjects' performances of the feeding task allowed its repeated measurement to yield sensitive measures of uncontrolled sources of variability.

Dependent variables. Previously, Alavosius and Sulzer-Azaroff (1985) described how patient transfer techniques were task analyzed, incorporated into checklists, and used to evaluate the safety with which care givers lift and transfer physically disabled individuals. For this study, those checklists were used to measure subjects' on-the-job performance of the transfer tasks.

A similar observational recording method was designed for the techniques used to position and feed dependent patients. Lattimore, Stephens, Favell, and Risley (1984) described an observational system to measure proper positioning of handicapped, nonambulatory patients. Their system evaluates how well a patient is positioned in various postures by measuring the outcome of positioning tasks, rather than the conduct of the task itself. Their system was used as the basis for task analyses of the positioning procedures. To ensure that the feedback was consonant with the facility's in-service training, the facility's trainers reviewed all task analyses. The task analyses of positioning and feeding procedures are presented in Tables 1 and 2, respectively.

Table 1
Task Analyses of Positioning Procedures

Step	Component
Seated in wheelchair	
1	Inform resident what you are to do.
2	Lock wheelchair brakes.
3	Position resident's buttocks squarely into the seat.
4	Stand behind and close to resident.
5	Grasp resident's arms and cross at chest, lift/pull resident to back of chair.
6	Lift with arms. Back remains straight.
7	Center resident's head and shoulders over hips.
8	Fasten seat belt across pelvis.
9	Place feet on footrests, if available.
Lying on side	
1	Prepare and clean area, obtain materials to go beneath resident.
2	Check if person is dry (change if not).
3	Inform client what you are to do.
4	Stand close to and in line with resident.
5	Locate head, shoulders and pelvis against bolster.
6	Use pull rather than push motions when moving client, when possible.
7	Set spine when bearing weight (no twists).
8	Place a pillow under client's head and between legs.
9	Place pillow at chest (hip to shoulder).
Supine	
1	Prepare and clean area, obtain materials to go beneath client.
2	Check if client is dry (change if not).
3	Inform resident what you are to do.
4	Stand close to and in line with resident.
5	Place a pillow beneath client's head.
6	Use pull rather than push motions when moving client, when possible.
7	Set spine (no twists) when bearing weight.
8	Lift bed rails up, side supports in place.

Personnel. The senior author and two research assistants conducted the observations. None of the research personnel were members of the organization's staff. The senior author recruited, trained, and supervised the research assistants and informed them of the general purpose of the study, but kept them naive as to the interventions, schedules of feedback, and specific target tasks. The assistants served as primary observers, and the senior author collected reliability observations and provided all feedback. Feedback was delivered at times when the primary observers were not present in the experimental setting.

Data collection. Prior to the start of the study, the senior author told each subject that the research staff would observe her routinely while she worked with her patients. Subjects were asked to indicate

Table 2
Task Analysis of Mealtime Procedures

Step	Component
Prepare dining area for meal	
1	Obtain meal and utensils. Place nearby.
2	Position resident in front of staff person.
3	Lock wheelchair brakes.
Position resident for meal (prevent choking)	
4	Have resident sit straight (not reclined). Position head over shoulders.
5	Prompt head upright (not tipped back).
6	Prompt head forward (facing midline).
Offer solid foods	
7	Place small amount of food on spoon and prompt client to open mouth. Use touch or odor prompt for blind residents.
8	When open, place spoon straight into mouth.
9	Press spoon, gently, down on tongue to prompt for lip closure.
10	Slowly remove spoon—do not scrape across teeth or gums.
11	Prompt for lip closure (press upward on lower lip with finger) if mouth is open
12	Use napkin to wipe face if necessary.
13	Observe for swallowing—once swallowed, repeat 7–12. Allow time for complete swallow—do not rush meal.
Offer liquids	
14	Offer liquids, in small amounts, throughout the meal. Touch cheek of blind client.
15	Position client's head upright, over shoulders, not tipped back.
16	Face head forward (toward midline).
17	Place rim of glass on lower lip. Press gently downward. Lips should seal on rim to prevent spilling.
18	Provide small amount of liquid—watch for swallow. Press gently on lower lip to prompt for lip closure.

the times when they were likely to transfer, feed, and position their clients.

Observers were trained to score reliably the correct performance of target behaviors by first viewing and scoring videotaped examples, then by scoring actual performances. Once they mastered the observational procedures, the observers visited each health-care worker weekly to view and score performance of the selected tasks. While viewing each task, observers scored each task component as occurring correctly, incorrectly, or as "not applicable." A component was checked "correct" if it occurred in the proper sequence and its topography was consistent with the response definition. Task components that were omitted or performed inconsistently with the response definition were scored "incorrect." In some cases, task components were not relevant to the particular performance and circumstance; these were scored "not applicable" (e.g., one patient was incapable of turning his head forward to midline, prompting him to do so during meals was therefore inappropriate and observers scored this component "not applicable" when observing his meals).

Observers viewed each task and scored each component as it was performed. In the case of mealtime procedures, the observer scored three repetitions of the steps involved in presenting the patient with a mouthful of food during each meal. Observers were instructed to be as unobtrusive as possible during data collection. During the course of over 1,100 on-the-job observations, the observers became a common sight in the experimental setting: For several months, one or more members of the research staff were on site 7 nights per week.

Once the observational recording system was refined and revised, the research assistants toured the experimental setting 2 to 4 days per week between 4:45 p.m. and 11:00 p.m. and monitored each worker engaging in the targeted performance. The observers scored the performance of two to four samples of each task by the subjects present. This procedure continued during the entire baseline and feedback phases. Following feedback, the frequency of observations was reduced until they occurred only weekly. To assess the maintenance of correct performance, follow-up measures were then taken routinely for approximately the next 7 months.

Interobserver agreement. Simultaneous and independent observations were conducted periodically throughout the study to assess the stability of the measurement system. Percentages of occurrence, nonoccurrence, and overall agreement were computed by dividing the number of observer agreements by the number of agreements plus disagreements, then multiplying by 100. During the course of data collection, 49 reliability sessions were conducted during baseline, 26 following instructions, and 92 during follow-up phases. The overall mean percentage agreement for all 167 interobserver agreement sessions, calculated on a component-by-component basis, was 95.3%. Interobserver agreement on occurrence of correct practices ranged from 50% to 100%; mean overall agreement on occurrence was 86.4%. Interobserver agreement on nonoccurrence of correct practices ranged from 0% to 100%; the mean overall agreement on the nonoccurrence of correct practices was 80.9%. Mean percentages of agreement for occurrence and nonoccurrence of each response class were 87.9% and 77.8% for transfers, 94.3% and 85.1% for positionings, and 92.8% and 85.6% for meals.

Consumer satisfaction and cost estimates. A consumer satisfaction inventory (Wolf, 1978) was administered during follow-up to asssess how the different feedback schedules were judged by those involved. The time required to observe employees, develop and conduct interventions, and evaluate effects were estimated.

Procedures

Baseline. Data were recorded for 8 to 10 weeks. Stability of performance was reached when three consecutive measures of performance fell within the ranges established by preceding observations.

Instructions. Each subject was provided written instructions on how to conduct the selected tasks properly. These instructions consisted of the task analyses for each activity. The experimenter asked each subject to read the instructions carefully and then to try the recommended procedures with her patients. After instructions were provided, baseline conditions were resumed.

Intermittent feedback. To resemble many typical schedules, intermittent feedback was provided for performance of one response class (either transferring or positioning). Each week, the experimenter selected 1 day to visit each subject and observe three consecutive performances of the designated task. The experimenter viewed and scored each performance, then immediately reviewed the information with the subject. The oral and written feedback indicated whether the subject had performed each component of the selected task correctly and included specific suggestions for improving subsequent performance. Approval of increasingly correct performance was included when appropriate. The experimenter then returned a week later and again provided three feedback messages on three consecutive examples of that task. This schedule of weekly feedback sessions continued until the employee demonstrated mastery of that task (as described below). Thus, the intermittent feedback schedule was an FI schedule of reinforcement.

Dense feedback. Concurrent with the intermittent feedback, dense feedback was initiated for a second response class (either transferring or positioning). This was done to avoid sequence effects that might influence the outcomes of feedback messages had one schedule been completed before the other began. In this case, the investigator delivered feedback many times each day, following approximately every one or two performances. This continued until the subject mastered the task. All subjects required 2 to 3 days of intensive feedback in order to do so. Thus, the dense feedback resembled a CRF schedule. Other than the schedule, the dense feedback was identical to that given intermittently. The format, feedback source, immediacy of delivery, and duration of message were essentially equivalent, regardless of schedule.

Mastery criteria. Under both schedules, feedback continued until the employee had correctly performed 90% of the components of each targeted task three or four successive times over 2 consecutive work days. Once this was accomplished, the employee was advised that she had mastered the task and that feedback on that task would now end.

Follow-up. An investigation of whether or not performance was maintained over time was critical to the assessment of the two feedback schedules. For this reason, data continued to be collected by the research team for more than 7 months. Following 5 months of weekly follow-up assessments, the observational schedule was reduced. Biweekly and then monthly probes were conducted to evaluate long-term maintenance. No feedback was provided during follow-up observations.

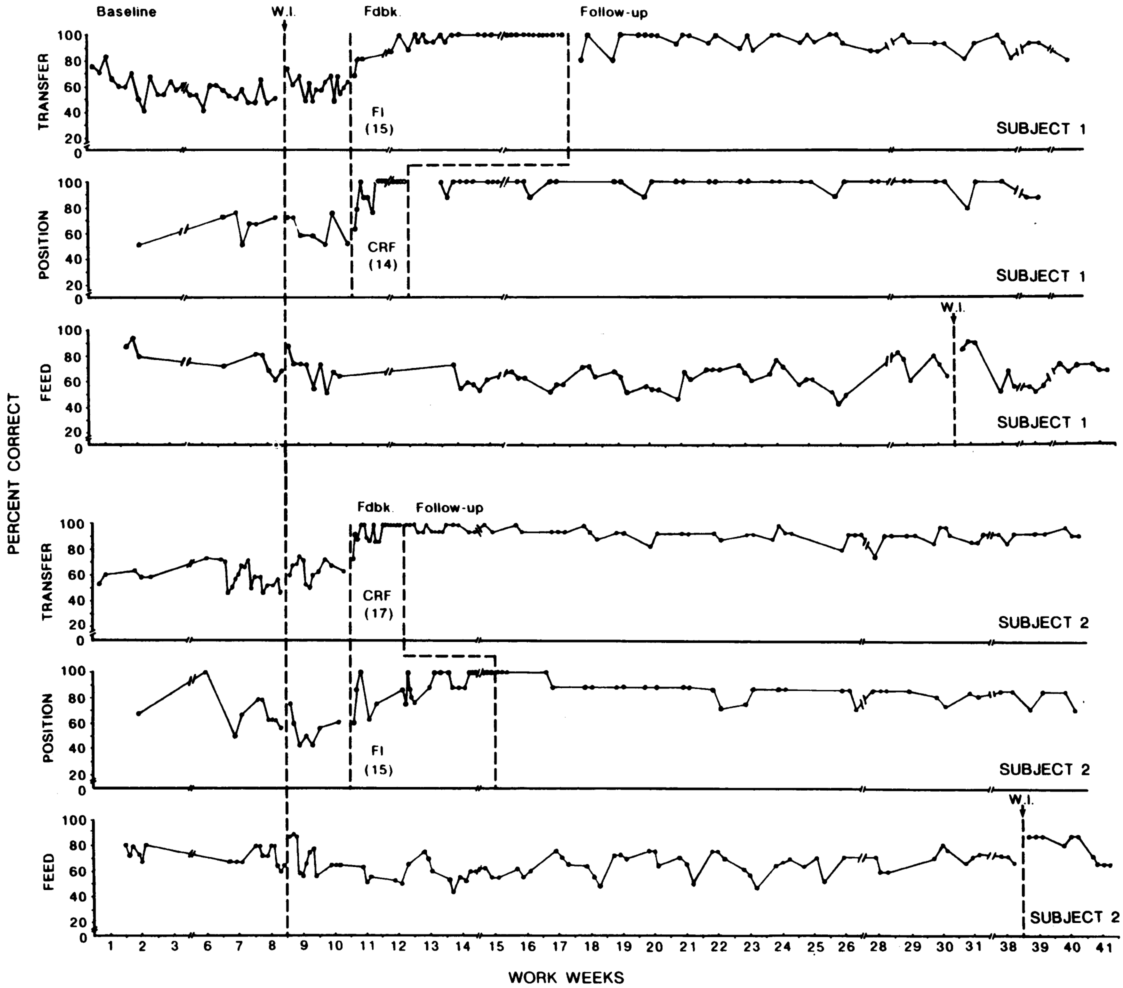

Figure 1. The percentage of each task performed correctly by Subjects 1 and 2 during each condition. WI = written instruction; FI = fixed-interval feedback; CRF = continuous feedback. Breaks in the timeline indicate employee absences (due to holidays, vacations, etc.).

Experimental Design

By staggering the lengths of the baselines in multiple baseline fashion and comparing concurrent, but independent, performances under the two different schedules of feedback, it was possible to analyze patterns of change within individuals. Changes in the level, trend, and variability of each series of measures taken on each subject's work performances were examined to determine whether the schedules affected performance improvements. To help control for any potentially confounding task–schedule interaction, the response classes receiving a particular schedule of feedback varied across subjects in a counterbalanced fashion. This design permitted simultaneous evaluation of the two feedback schedules, with each subject receiving all interventions. Intervention was not attempted with the third response (feeding) until the end of the study, but was measured throughout the study as a control for potential subject reactivity to the presence of observers, experimenters, passage of time, and other conditions introduced by the research. Although observers were instructed to intervene if they saw staff performing dangerous behaviors, this was never necessary.

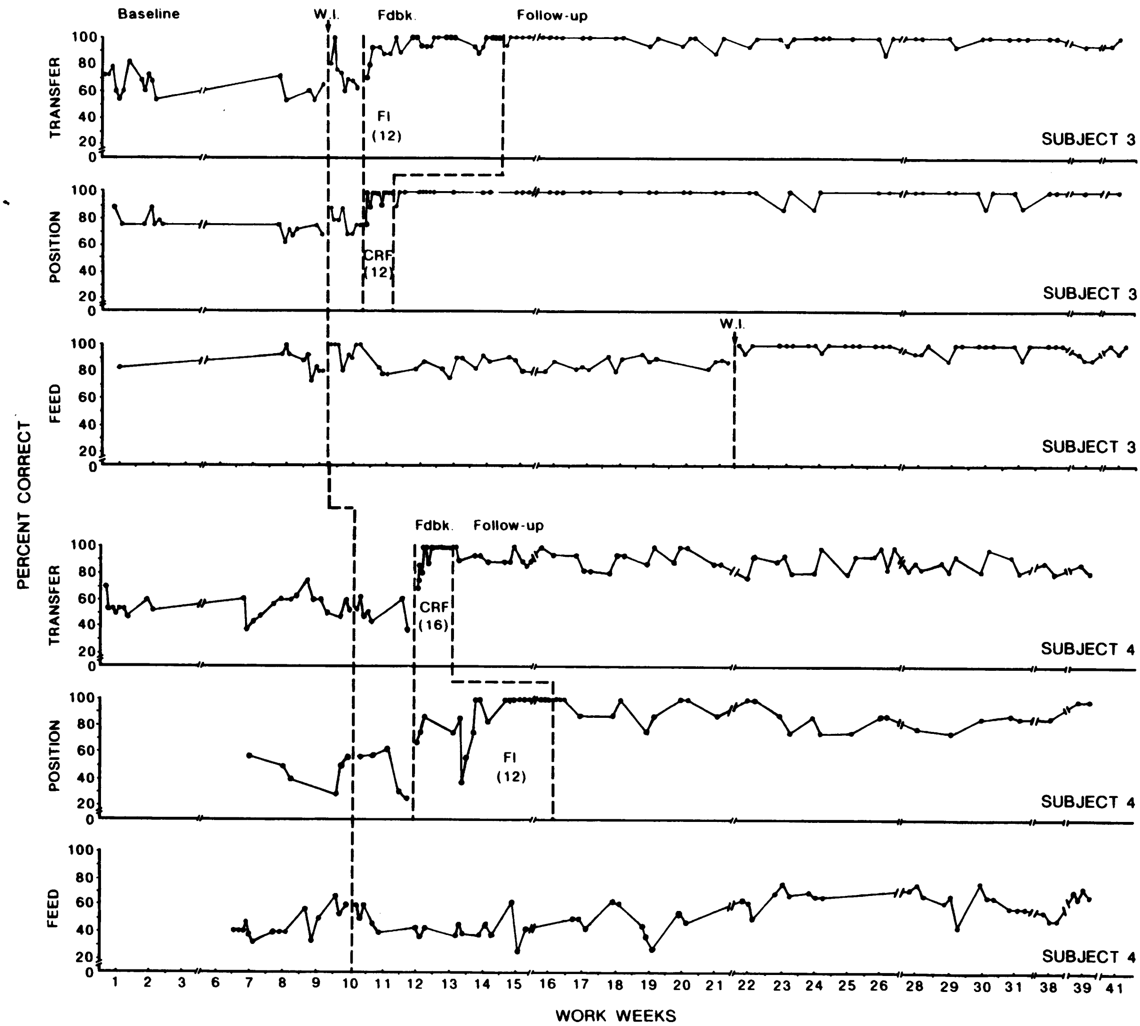

Figure 2. The percentage of each task performed correctly by Subjects 3 and 4 during each condition. WI = written instruction; FI = fixed-interval feedback; CRF = continuous feedback. Breaks in the timeline indicate employee absences (due to holidays, vacations, etc.).

RESULTS

Figures 1 and 2 present the percentage of each task performed safely by each subject during observations made during baseline, intervention, and follow-up phases. The number of feedback messages provided on each task is shown. The mean percentage of each task performed correctly by each subject during critical periods in the experiment is presented in Table 3. The data presented for the feedback condition show the average of each task as performed during the actual feedback sessions only.

Baseline

All subjects performed variably on all tasks during baseline, and incorrect conduct of multiple task components was often noted. Baseline performances of all observed tasks tended to vary unsystematically around mean values ranging from 46.4% to 86.2% of the tasks performed correctly.

Written Instructions

Two subjects performed some tasks more correctly after written instructions were provided. See Figure 1 for changes in feeding by Subject 2 and

Table 3
Mean Percentage of Tasks Correctly Performed During Each Phase of Experimental Conditions

			Experimental condition							
						Follow-up (month)				
Subject	Task	Schedule	Baseline	Instruct 1	Feedback	1	2	3	4	Instruct 2
1	T	FI	58.0	59.2	93.4	96.0	96.3	94.6	90.4	
	P	CRF	64.4	61.6	92.2	98.4	97.3	100	98.4	
	F	N	67.0	66.0	—	—	—	—	—	65.2
2	T	CRF	58.5	64.6	94.8	96.8	93.9	91.7	91.7	
	P	FI	68.2	55.3	93.4	92.8	84.2	85.6	85.2	
	F	N	72.7	67.1	—	—	—	—	—	82.3
3	T	FI	64.2	73.3	94.9	99.4	98.3	97.5	99.3	
	P	CRF	74.6	77.6	96.0	99.1	100	100	96.5	
	F	N	86.2	88.7	—	—	—	—	—	98.7
4	T	CRF	54.9	50.8	93.9	90.8	90.5	89.4	89.8	
	P	FI	47.0	46.1	92.0	93.6	87.7	80.6	83.1	
	F	N	46.4	45.3	—	—	—	—	—	—

Note. T = transfers; P = positionings; F = feeding procedures; FI = intermittent; CRF = intensive; N = no feedback. Because feedback was not provided on feeding procedures, no follow-up measures were taken on this task. Data listed in the Instruct columns show the average of performance scores collected during the 1-month period subsequent to provision of written instructions.

Figure 2 for changes in transfers, positionings, and feeding by Subject 3. These changes were not enduring, and performances affected by these initial instructions returned to baseline levels within several days.

Instructions were provided a second time, for dining procedures only, after feedback deliveries ceased on transfers and positionings. Improvements were greater than previously and, in one case (Subject 3), more lasting. Note also that Subject 4 showed improvement when her co-worker (Subject 3) received the second set of instructions for meals, as shown in the elevated, stable level of her mealtime scores obtained after Week 22 (Figure 2). A reverse in a local downward trend in Subject 4's feeding skills (see Weeks 28 and 29) occurred during Week 30. This effect occurred as another co-worker (Subject 1) received the second set of instructions for meals. Subject 4 did not receive the second set of instructions because she was assigned to another work site before this could be accomplished.

Schedule Effects During Feedback

Regardless of delivery schedule, all responses treated with feedback steadily improved, although the response class for which intensive feedback was delivered changed much faster than that for which intermittent feedback was provided. This effect was reproduced as feedback was introduced in staggered succession across subjects. Table 4 displays the number of days it took each subject to achieve mastery of the two tasks for which they received feedback.

Following delivery of 12 to 17 feedback mes-

Table 4
The Number of Feedback Messages and Work Days Required to Achieve Mastery of Transfer and Positioning Skills

Subject	Task	Schedule	Feed-back mes-sages	Work days to mastery
1	Transfer	FI	15	25
	Position	CRF	14	3
2	Transfer	CRF	17	3
	Position	FI	15	25
3	Transfer	FI	12	20
	Position	CRF	12	2
4	Transfer	CRF	16	2
	Position	FI	12	20

sages, all subjects' performances of the selected tasks reached ceilings of correct practice and were maintained at these levels for at least several days. Measures of feeding procedures, collected while transfers and positionings were being treated with feedback, indicated that performance of this task did not change substantially.

Follow-Up

Follow-up measures taken over a period of 7 months indicated that performances tended to be maintained at relatively high levels regardless of the feedback schedule. In some cases, responding became more variable with the passage of time, and some task components were again observed to be performed incorrectly. However, performance levels measured during follow-up conditions seldom overlapped with those obtained during baseline observations.

Schedule Effects During Follow-Up

Inspection of Figures 1 and 2 and Table 3 indicates that percentages of correct performance differed among subjects following termination of feedback. For instance, follow-up measures taken 3 months later indicated that performance continued to be at or above mastery level for Subject 1 (97.5% of transfers, 100% of positionings); whereas at this juncture, correct performance was less frequently observed for Subject 4 (89.4% of transfers, 80.6% of positionings). Note that maintenance of correct performance of both transfers and positionings was strongest with Subject 3, weakest with Subject 4, and intermediate with Subjects 1 and 2.

Reliable differences were not evident in the maintenance of correct practices within subjects and across schedules. Performances established under both dense and intermittent feedback schedules were maintained at levels that exceeded those established during the corresponding baselines. Essentially equivalent levels of correct performance were observed following both schedules of feedback.

Consumer Satisfaction and Cost Estimates

All subjects agreed that the feedback improved the quality of their performance of transfers and positionings and recommended such feedback to co-workers. None sustained any injuries in the 7 months following training. Approximately 66 hr were required to develop and 12 hr per week to operate and experimentally evaluate the feedback program. Most of the development time was spent analyzing job tasks and training observers. Feedback messages were brief and were delivered during the course of actual work routines. Thus, feedback did not interfere with subjects' conduct of their work. Under the dense feedback schedule, subjects mastered the tasks in 2 or 3 consecutive work days and required 12 to 17 feedback messages. Under intermittent feedback, subjects mastered the tasks in 4 to 5 weeks and required 12 to 15 messages.

DISCUSSION

The results indicated that individually and privately delivered, written and oral feedback was effective in improving the performance of two health-care routines. Improvements were noted when and only when feedback was provided. Thus, this study demonstrated a functional relationship between improvements in health-care practices and individualized feedback. This replicates previous studies (e.g., Alavosius & Sulzer-Azaroff, 1986; Lattimore et al., 1984) that found health-care routines enhanced with feedback. As in the studies of other researchers (e.g., Weiner, 1983), once a mastery level was achieved, low rates did not occur under FI schedules.

Written instructions resulted in generally weak and short-lived changes. This is consistent with the findings of other researchers (e.g., Quilitch, 1975; Shook et al., 1978) who reported unimpressive results when only antecedent methods were used to improve workplace performance.

Acquisition of correct routines was much more rapid under dense feedback. But, given the sensitivity of the measures and clarity of the response definitions, practical differences in the persistence of these health-care tasks were not detected as a function of the different schedules. Pending additional replications, caution should be exercised in generalizing this finding to other work tasks performed in other settings. However, our results suggest that following rapid, intensive feedback, performance can be maintained just as well under the more commonly used intermittent programs. Workers' exposure to risk of injury due to unsafe practices may be reduced rapidly by using acclerated training programs at the onset of their employment. These findings suggest that promoting rapid behavior change with a dense schedule of feedback will not necessarily lead to impaired maintenance.

The extended maintenance of target behaviors under conditions of discontinued feedback is not typical of findings in other feedback studies (Prue & Fairbank, 1981). Many factors possibly contributed to this durability. For example, the refined techniques may have been maintained by natural reinforcers (e.g., less effort) intrinsic to the tasks. With on-the-job training, common stimuli (e.g., the patients and residential settings) were present during acquisition and follow-up conditions. The subjects also learned verbal rules describing correct performance; these too may have cued continued safe performance. Finally, subjects reported giving other employees feedback on their performances; this peer support may have enhanced maintenance.

Prompted by the feedback, the recommended practices accomplished the same purposes as the techniques employed previously (moving patients) but took less time and effort. Baseline observations revealed nonessential and strenuous movements, including carrying patients across unnecessarily long distances, pivoting with patients through overly wide arcs, and twisting and bending while positioning patients. These wasteful motions required extra effort and posed risks of strains and sprains due to excessive physical stresses. All subjects reported that transfers felt easier to do after feedback; half felt positionings were easier to do after feedback, and half described positioning effort as about the same. Performance variability, both between and within subjects, decreased after feedback, and the patients appeared less resistant to the targeted care as their treatment became more standardized. Thus the new responses, occasioned and shaped by the feedback, were probably reinforced intermittently by natural contingencies.

The feedback messages presented specific rules describing optimal technique. Correspondence between the subjects' actions and these rules was likely reinforced by both the praise statements embedded in the feedback as well as the reduced effort encountered in using the refined technique. All subjects reported that they provided new employees with both oral instructions and performance feedback on their care techniques. Although the subjects' efforts to train co-workers were not examined systematically, the fact that all reported doing so shows that they were fluent with the response definitions.

The initiation of feedback procedures among co-workers was an unexpected benefit. Other researchers (e.g., Sulzer-Azaroff, Fox, Moss, & Davis, 1987; van den Pol, Reid, & Fuqua, 1983) have examined peer training procedures for establishing and maintaining safety-related skills among workers. Although they found that peer training could be effective, these researchers reported that their procedures were not acceptable due to excessive time and effort requirements.

The costs to develop and operate this program may appear high, but these estimates include activities required for research precision. These technological costs could be reduced without sacrificing the program's utility. Considering the enormous cost to workers and organizations of even a single back injury (estimated to be between $15,000 and $30,000), training costs pale in comparison. In this study, dense feedback required approximately 12 to 18 hr of actual training time to bring an employee to mastery, and the intermittent training required approximately half that time. A trainer using the intensive schedule must shadow the employee during work and wait for the opportunity to provide feedback. Using an intermittent schedule, a trainer can be more efficient by arranging training sessions at periods of peak performance and thereby minimizing the wait for successive performances. In many cases it may be advantageous to have supervisors use dense schedules, because doing so will require close and continued contact between managers and subordinates. During the time spent shadowing an employee, the manager can observe other work duties and provide supervision in those areas. Further research to develop more efficient, but equally effective, supervisory systems (e.g., peer feedback, other schedule arrangements, etc.) is recommended.

The positive, although inconsistent, effects of instructions alone, shown with some subjects, suggest that well-developed, functionally valid instructions might be effective in promoting change. Perhaps after receiving feedback for other response classes, instructions alone might be effective at establishing safe work habits. Histories of exposure to feedback contingencies should be examined to determine how these might establish generalized stimulus control by rules.

The effects of feedback and schedule variations on classes of behavior devoid of any risks need to be assessed with nonvolunteers to determine whether performance can be improved with these populations as well. Due to the unusually extensive number of observations dictated by the research requirements of this investigation (over 1,100 on-the-job observations), only 4 subjects participated. The results were reproduced across two classes of work behaviors to constitute eight replications. Although the results were robust, replication of this study with larger subject samples is recommended to evaluate changes in injury rate as a consequence of improvements in safety practices and to test the generality of these findings.

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