

*BEHAVIOR ANALYSIS IN CONSUMER AFFAIRS: ENCOURAGING
DENTAL PROFESSIONALS TO PROVIDE CONSUMERS WITH
SHIELDING FROM UNNECESSARY X-RAY EXPOSURE*

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An unobtrusive observation system was developed to determine the extent to which dental professionals in two communities provided lead shielding to patients during X-ray exams. A lengthy baseline revealed low and irregular provision of shielding among half of these professionals. Subsequently, a program was undertaken by a consumer's group in which these professionals were requested to provide shielding and were given confidential feedback regarding its use during the baseline period. The provision of shielding dramatically increased at all offices and was maintained throughout a follow-up period extending to more than 9 months after the program's implementation. Little or no generalized effect was observed in the occurrence of three collateral behaviors that were also assessed throughout the study.

DESCRIPTORS: community behavior analysis, behavioral community psychology, safety, countercontrol

The prospect of a science and technology of human behavior contributing to the design of the social contract is deeply rooted in the history of the experimental analysis of behavior (Skinner, 1953, 1971). This prospect has been an impetus for a program of research whose scope, nature, and purpose are suggested by terms such as community behavior analysis (Greene, 1981) and behavioral community psychology (Briscoe, Hoffman, & Bailey, 1975). This research has introduced behavioral engineering to systems responsible for energy conservation (Winett, 1980), traffic safety (Greene, Bailey, & Barber, 1981; Van Houten & Nau, 1981), and health care (Reiss, Piotrowski, & Bailey, 1976).

Although community behavior analysis seems promising, it has generally introduced no more change in these systems than necessary to produce specific changes in the behavior of its consumers. For example, although consumers have been encouraged to comply with health care systems and to curtail consumption of fossil fuels, little complementary research has addressed the questionable practices of physicians and pharmaceutical companies (cf. Bergmann, Wolfe, & Levin, 1982) or the development of alternative energy sources such as solar power (Stern & Gardner, 1981).

Some, in recognizing this limitation, have argued that a greater depth and breadth of behavioral engineering will not occur until community behavior analysis interfaces with those disciplines that have traditionally been involved with issues of broad social concern (Fawcett, Mathews, & Fletcher, 1980; Greene, 1981; Winett, 1980; Nader, Note 1). Such disciplines include economics, urban planning, and environmental engineering. In particular, Greene (1981) has suggested that a viable alliance for

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improving community affairs could be forged by the cooperative efforts of community behavior analysis and consumer action groups, particularly public interest research groups (PIRGs).

PIRGs are an organized network of university-based, consumer action groups established by Ralph Nader in the 1960s and 1970s. Approximately 175 PIRGs now exist which sponsor a range of programs to influence decisions on important social issues such as pollution control, education, and health care (Nader & Ross, 1972). Given the nature of those issues, it seems there would be many areas in which a cooperative effort between PIRGs and community behavior analysts could benefit the community.

The present study illustrates such an effort. It was undertaken to encourage dental professionals to reduce their clients' exposure to radiation during diagnostic X-rays.

Diagnostic and therapeutic X-rays represent the largest single source of man-made radiation to which the U.S. population is exposed (Laws, 1974; Morgan, 1971). Although the levels of radiation incurred from most diagnostic and therapeutic X-rays are relatively low, they are associated with the same maladies (e.g., cancer, genetic damage) caused by higher radiation levels (International Commission on Radiation Protection, 1966; Seltser & Sartwell, 1965). Such maladies induced by dental and medical X-rays may account for as many as 1,000 deaths each year (Stewart, 1970). Furthermore, the effects of radiation exposure are cumulative: Receiving several low doses may be as hazardous as receiving one large dose (Laws, 1974).

The benefits of diagnostic and therapeutic X-rays usually outweigh the risks. However, unnecessary exposure can be minimized by properly maintaining and operating modern equipment and by administering X-rays only when clinically indicated—not as a matter of "routine" (Gofman, 1981; Laws, 1974). Finally, patients should be provided lead shielding (aprons), when such shielding does not inter-

fere with the examination itself, to minimize exposure to secondary radiation. Secondary radiation is created when the primary X-ray beam strikes an object which, in a chainlike fashion, absorbs and emits radiation to other objects until an entire room is irradiated (O'Brien, 1967). Because lead aprons reduce unnecessary exposure of the gonads and other critical organs by 98% (Bean & Devore, 1969), virtually every pertinent professional organization recommends providing patients with shielding during X-ray examinations (American Dental Association, 1972, 1974). In some states such shielding is required by law; in others, it is recommended in the rules and regulations for operating X-ray equipment (ADA, 1972).

Despite these recommendations, the Department of Health, Education, and Welfare reported that over 90% of medical and dental X-rays are administered without shielding patients (cited in Laws, 1974). Many agencies and organizations (e.g., Food and Drug Administration, 1980) have responded to this problem by conducting educational campaigns aimed at consumers. However, an alternative or complementary strategy would be to encourage dental and medical professionals themselves to protect their patients with lead shielding.

Such a strategy was adopted in the present study. Initially, IPIRG (Illinois PIRG) and the Behavior Modification Program (in the Rehabilitation Institute) at Southern Illinois University conducted a preliminary survey of 25 graduate students. All 25 students had been X-rayed on their last dental visit, but only two (8%) reported receiving a lead apron during the exam. In addition, informal questioning of area residents indicated that many dental professionals had not provided protective shielding.

Based on these results, an experiment was conducted to assess the extent to which lead aprons were being provided by local dental professionals. Subsequently, a program was implemented to encourage many of these professionals to provide lead shielding to consumers.

METHOD

Subjects and Setting

All dental offices whose practices were listed in the yellow pages of the phone directory of two small midwestern cities (pop. 9,866 and 27,000) were subjects. There were twenty such offices but four were eliminated from the experiment: Three had gone out of business and the other specialized in oral surgery. Accordingly, a total of 16 dental offices were subjects in the experiment.

Principal Target Behavior: Measurement System

The principal behavior of concern in this study was the provision of lead aprons to consumers during X-ray examinations. An unobtrusive measurement system was devised to ascertain the extent to which dentists, or their assistants at each office, provided protective aprons to their customers during X-ray exams. Specifically, 5 to 10 times each week an observer entered the periphery of the parking lots of each dental office. The observer then recorded (by speaking into a cassette recorder) the license numbers of all parked vehicles. The license numbers were then submitted to the Parking Division of the Southern Illinois University-Carbondale campus and the owners of the vehicles identified. (This research was reviewed by the Human Rights Committee of Southern Illinois University. Permission to acquire access to vehicle registration records was granted by the Illinois Office of Secretary of State (Division of Data Processing). Such records are publicly available for various purposes including research.)

Surveying Recent Dental Patients

Vehicle owners were contacted by phone, within 14 days of license number collection, and informed that the Rehabilitation Institute was doing a survey of citizens regarding their experi-

ence and satisfaction with dental services. The interviewer asked to speak with any adult who had had the most recent dental appointment. The citizens were not informed of the fact that the interviewer was aware of their recent dental visit. On completion of the survey the citizen's name was disassociated from the results.

The initial survey questions were designed to ensure that the citizen was not a dental professional. Subsequent questions required citizens to recount the approximate date of their last dental visit and to identify, by name, their dentist. These questions enabled the interviewer to ascertain with greater certainty whether the person went to the target dental office on the date the license number had been collected. It was emphasized that the ideal family member to answer the survey would be one who had been to the dentist quite recently. If the interviewee had not been to the dental office in less than a month or had been to a dental office other than where the license number was collected, the survey was administered but its data were disregarded in the analysis.

A series of questions was asked regarding the citizen's experience during the dental visit. Of particular interest in this study were the questions "were you X-rayed?" and "if you were X-rayed, did the dentist or dental hygienist provide a lead apron?" The surveyor recorded the responses of the subjects in one of three possible categories: "Yes," "No," or "Cannot Remember." Citizens' definitive responses (i.e., "Yes" or "No") to this question constituted the primary data of this study.

In the course of the study, 4,247 vehicle license numbers were recorded and submitted to Parking Division. Of these, Parking Division was able to identify the owners of 3,072 vehicles. A total of 2,232 of these owners were contacted in the survey. (Some individuals were not listed in the phone book; others could not be reached in the 14-day time period.) Interviews with 1,527 of these citizens confirmed they had been to a particular target dental office. (Some

refused interviews or the interview was completed by a nontarget individual.) Of these, 850 reported having been X-rayed and 841 provided a definite response regarding whether or not they had been given lead shielding.

Collateral Target Behaviors: Measurement System

Two collateral target behaviors were assessed during the interview. Although they were not the principal behaviors under study, they were assessed to measure possible corollary effects of the intervention package and to provide relevant information for possible use in subsequent studies.

Explanation for x-ray examination. The citizens were asked, "When X-rays were taken, was a reason specified as to why they were needed?" Responses were recorded as "Yes," "No," or "Cannot Remember." The citizen was asked to recount the explanation, if any, provided by the dental professional. This was recorded verbatim and later categorized as either a "clinical" or "nonclinical" explanation. Reasons classified as "clinical" had to contain a statement indicating the X-ray was taken to detect or verify a specific dental problem (Laws, 1974). For example, if the consumer stated, "The dentist suspected a bone fragment could have been left in my mouth after my tooth was pulled," it was categorized as "clinical." In contrast, if the consumer's stated reason indicated the X-ray was a normal part of the visit (e.g., "The hygienist said that it was just part of the routine."), it was classified as "nonclinical." Finally, citizens were asked whether the reason (clinical or nonclinical) was given at the initiative of the dental professional or whether the customer had asked for a reason.

Providing consumers with price information. Citizens were asked, "Were you informed of the cost of the dental services before they were provided?" Responses were recorded as "Yes," "No," or "Cannot Remember." Again, citizens were asked if they inquired about the price in-

formation or if the dental personnel spontaneously provided the price information.

Integrity and Reliability (Verification) of Measurement

A number of precautions were taken to ensure the reliability and validity of the measurement system. First, patients were interviewed within 2 wk following their dental appointment. Second, to prevent surveying either dental patients or actual dental professionals more than once, the experimenters maintained a license number rejection list. Any license number that reappeared during the observation period was not included a second time (to avoid arousing suspicion or annoying citizens).

Finally, the target behaviors, particularly the primary target behavior (provision of lead apron), is a rather discrete and conspicuous event. Thus, an individual, particularly one who had recently been X-rayed, could probably provide an accurate report regarding the occurrence of this target behavior. However, an additional precaution was devised to ensure the reliability of the survey data. Specifically, observers (graduate students with observational experience and some undergraduates) were enlisted to secure dental appointments as patients at the target dental offices. During these appointments (probes), the observers recorded which target behaviors occurred. This procedure is similar to the "pseudo-patient" procedure described by Winkler (1974).

Observer Training

The observers enlisted by the experimenters were taught to observe and record the occurrence of the primary target behavior (lead apron provision) as well as the two corollary behaviors during their dental appointments. In addition, observers were trained to observe and record a third corollary behavior:

Recency of last X-ray examination. Specifically, the observer was to note and record whether the dental professional inquired, either

verbally or in written form (e.g., on a medical history intake form), regarding the patient's (i.e., the observer's) last dental X-ray exam.

The purpose in obtaining this corollary measure was the same for obtaining the other two corollary measures (i.e., to assess possible side effects of the intervention and to gather information for possible use in subsequent studies). The importance of the dental professional inquiring about the recency of the last X-ray exam rests with the fact that research indicates that an accumulation of low levels of radiation in the body, such as the level received during dental X-ray exams, is more dangerous than one high level dose (Gofman, 1981), contributing to the recommendation that diagnostic X-rays be a minimum of 6 mo apart. This target behavior was measured only by the observers selected by the experimenter and was not assessed in surveying consumers, since access to dental office patient records is restricted, making verification impossible.

In summary, this study involved the measurement of four target behaviors: (a) recency of last X-ray examination, (b) explanation for the X-ray examination, (c) lead apron use, and (d) price information.

The experimenters discussed the target behaviors with the observers and demonstrated the recording system. Specifically, a code letter was assigned to each target behavior (R = recency of last X-ray exam, E = explanation for the X-ray exam, A = lead apron use, P = price information). The experimenter affixed four dry-transfer letters (REAP) to the observer's watchband and demonstrated how to remove the appropriate letter, using a thumb- or fingernail when and if the target behavior occurred. For example, if on the health history form a question required the observer to estimate when they were last X-rayed, the observer would place a thumb- or fingernail over "R" on the watchband and scrape it off. If a target behavior did not occur, the observer would not scrape off a letter.

Subsequent to this demonstration, the ob-

servers practiced observing and recording while viewing seven different videotaped simulations of a patient during a dental visit. The observer also assumed the part of a patient during role playing simulations of a dental visit.

Finally, to protect observers during their appointments in the event that a dental professional did not provide a lead apron, a lead gonadol shield was provided (G.E. Model #E3016DA). The shield is triangular with each side 20 cm long. Due to its shape, the shield fitted inconspicuously and comfortably underneath clothing and provided unobtrusive protection against gonadol exposure to radiation.

Experimental Procedures

Normal routine (baseline). A baseline reflecting the provision of lead aprons (as well as the corollary measures) was generated on the basis of the telephone surveys of consumers from each of the 16 dental offices. This baseline extended over a 14-wk period, following which eight dental offices were excluded from further assessment due to the fact that aprons were provided on a regular basis at these offices. The criterion for exclusion was 75% or more lead apron use as measured by the survey procedure. Baseline data continued to be collected on the remaining eight offices. There was no indication that dental offices discovered the existence of this survey or its purpose.

Verification observers completed appointments at the remaining target offices at intermittent periods during baseline. After the extended baseline assessment, all dental offices (including those excluded after the 14-wk period) were provided with one of two types of feedback packages regarding apron use.

Feedback plus prompt. Dental offices in which lead aprons were provided to less than 75% of the consumers who were X-rayed at that office (ascertained by telephone survey) received a specially designed feedback package. This package contained five pieces of information:

1. A cover letter explaining that a survey, cosponsored by the Illinois Public Interest Group and the Rehabilitation Institute at Southern Illinois University-Carbondale, was conducted to determine the extent to which consumers were being provided with lead shielding during X-ray exams at area dental offices. This letter simply explained that the survey reflected the responses of individuals who had been to the particular office. The letterhead of this letter identified the two cosponsors.

2. A concise statement of the recent findings regarding the potential dangers of low-level radiation exposure and the recommendations of various organizations (including the American Dental Association) that lead shielding should be provided to clients during X-rays.

3. Two sets of survey results presented numerically and graphically. The numerical information identified the total number of consumers that participated in the survey of all 16 practices. In addition, the percentage of these consumers who responded affirmatively to the question regarding the provision of lead shielding was reported. This same information was provided with respect to the individual dental practice that was sent this package.

This information was also presented graphically, as a histogram. Specifically, the graph depicted a bar reflecting the percentage of consumers who reported receiving lead aprons at the particular dental office where the package was delivered; a second bar indicated the percentage of consumers from all dental offices who reported receiving lead aprons; and, a third bar extended to 100% represented the "ideal" percentage of cases for using the lead apron.

4. A respectful request to the dental office to provide maximum protection for patients by regularly providing lead shielding to clients. Additionally, the dental office was informed that the surveys would continue and that a follow-up report would be sent in the weeks ahead.

5. Two peel-off stickers, on which were printed, "Use Lead Apron." One sticker was rectangular (60 mm × 85 mm); the other was cir-

cular (30 mm diameter). It was suggested that the rectangular sticker be placed directly on the X-ray machine to serve as a handy reminder to the dental professional to provide the patient with lead shielding. The circular sticker could be placed on the X-ray power switch to serve as an additional reminder.

These feedback/prompt packages were addressed to the dentists and delivered via certified mail. Return receipts were obtained so that the experimenters could verify the date that the intervention (feedback/prompt packages) were delivered to each office.

Feedback plus commendation. The dental offices in which assessment had been discontinued at the end of 14 wk of baseline (i.e., offices in which lead aprons were reportedly provided to more than 75% of the consumers) received the same information as the dental offices whose lead apron provision was less than 75%. However, instead of a request to increase their rate of lead apron provision, an expression of appreciation for providing safeguards (i.e., regularly providing the lead apron) during X-rays was substituted. No peel-off stickers were included. These feedback packages were also delivered via certified mail. Originally, eight dental offices were scheduled to receive the feedback/prompt package. However, during the course of the study reported lead apron use for Dental Office #8 rose to the 75% criterion, placing the office in the feedback/commendation group. Since Dental Office #6 (scheduled to receive the feedback/prompt package) and Dental Office #8 shared the same building and parking area, it was decided to continue surveys and observer verifications at Dental Office #8 to discover what effect, if any, the feedback/commendation package might produce. Therefore, seven dental offices received the feedback/prompt package and nine received the feedback/commendation package, with continued monitoring of only one feedback/commendation office (Dental Office #8).

Follow-up. All dental offices that had received the feedback/prompt packages were sub-

sequently mailed (first-class) a letter providing follow-up results. The letter provided the number of additional surveys completed for that particular dental office and the percentage of patients reporting lead apron use. A congratulatory statement for the increase in lead apron use and a questionnaire that the dentists were asked to complete were also included. The questionnaire included items that allowed the dentist to rate (usually a 5-point scale) the usefulness, accuracy, and appropriateness of the survey. This same questionnaire was also sent to all nontarget dental offices (i.e., those in the feedback/commendation group).

Data collection continued for 3-5 wk after delivery of the follow-up letter. In addition, a final follow-up assessment was made on the 59th and 60th wk of the study at all target offices. Thus, this final follow-up occurred after a period of 3.5 to 4 mo subsequent to the delivery of the follow-up letter.

Experimental Design

A combination multiple baseline and multi-probe design was used to assess the intervention effects. Specifically, Dental Office #1 received the feedback/prompt package at the end of week 21 of the study; Dental Office #2 received its feedback/prompt package 5 wk later at the end of week 26. At the end of week 35, the appropriate packages were received by the remaining target and nontarget dental offices. After the 43rd wk, Dental Offices #1 and #2 received their follow-up letters. Two weeks later (after week 45), follow-up letters were mailed to the remaining target dental offices.

The observers secured dental appointments to verify the results of the survey during both pre- and postintervention periods. These observations were distributed during the course of the experiment at the target dental offices in a multi-probe fashion (Horner & Baer, 1978).

Social Evaluation

In addition to the questionnaire that was mailed to dentists at follow-up, a similar ques-

tionnaire was sent to three individuals active in consumer affairs at state and national levels. This questionnaire also included an explanation of how license plate numbers were collected and patients identified. (The questions were worded in the conditional, i.e., as if the study was being considered and not a *fait accompli*.) Thus, the three individuals were asked to evaluate the appropriateness of that aspect of the project as well as its usefulness. However, only two of those three individuals responded to the mailed questionnaire, and the questions pertaining to the appropriateness of identifying and interviewing patients were answered only by one individual.

RESULTS

Lead Apron Use

The results from the experiment indicated the feedback plus prompt package was highly effective in promoting the provision of lead aprons during X-ray examinations by dental professionals. As Figure 1 illustrates, the provision of lead aprons at Dental Office #1, as reported by consumers, increased dramatically from an average of 8% during normal routine (baseline) to 100% after receipt of the feedback plus prompt package. This increase was verified by four trained observers who received dental services at Office #1. Prior to package delivery, two observers reported not receiving lead shielding. Two more trained observers obtained appointments with Dental Office #1 4 wk after package delivery and both reported receiving lead aprons during their X-ray exams. Finally, the follow-up period began at this office in the 44th wk of the study (nearly 6 mo after the initial delivery of the feedback/prompt packages). The provision of lead aprons remained at 100% through the 48th wk. Another follow-up assessment of consumers in the 60th wk, nearly a year after the initial intervention, indicated that the provision of lead aprons had diminished somewhat to 67.7%.

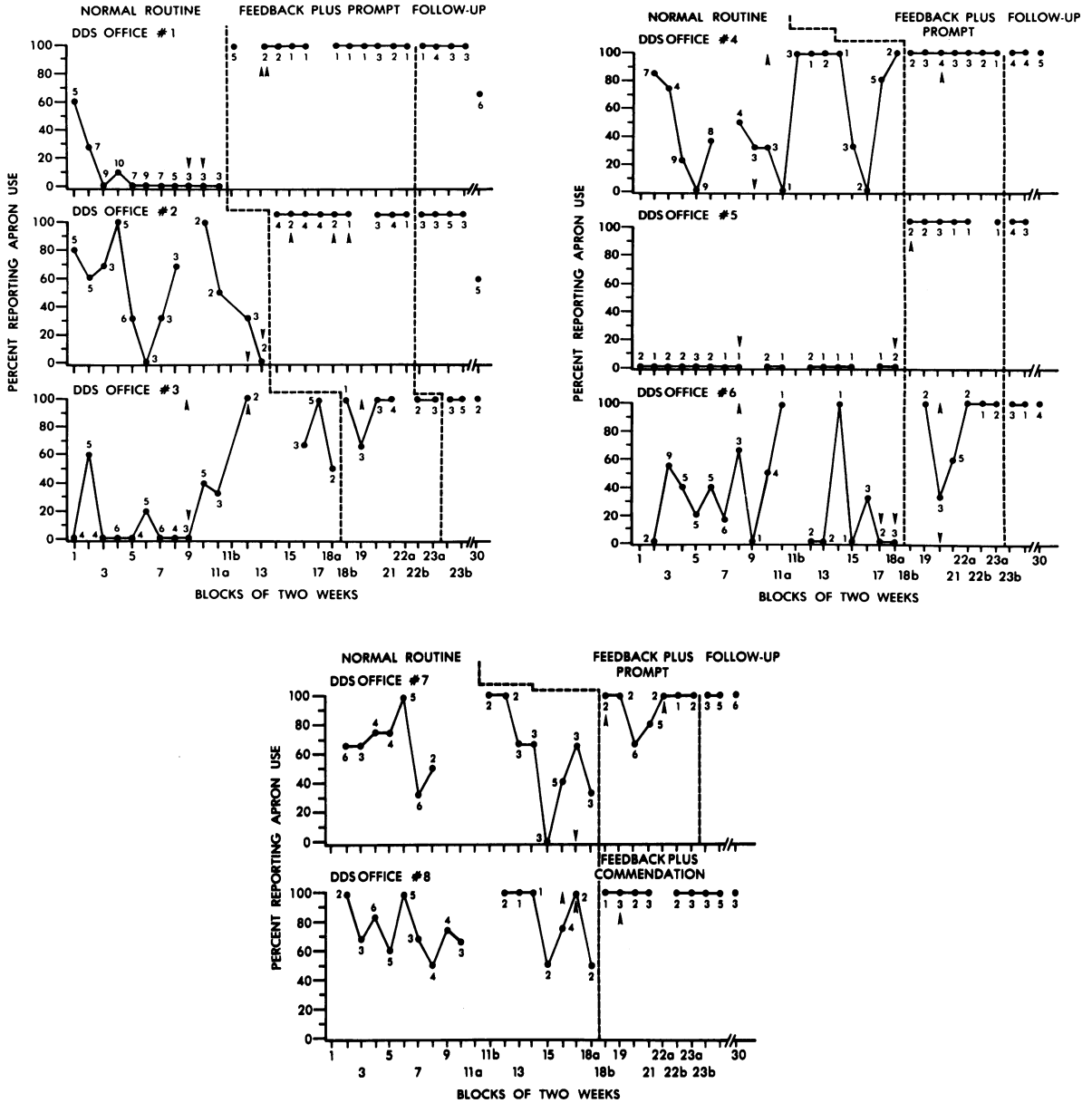


Fig. 1. Percentage of X-rayed consumers who reported receiving protective lead aprons during their exam. Data are presented for consecutive blocks of two weeks. The number of consumers contributing to each data point is identified for each block. When intervention was initiated at mid-block, the block has been separated into individual weeks (e.g., 23a and 23b). Arrows represent individual observer verification probes and point either up toward 100% or down toward 0% to indicate that the observer was or was not provided a lead apron during the X-ray exam. Gaps in data indicate periods in which data were unavailable (usually due to the dentist being on vacation).

Similar results were obtained at the second dental office where the feedback plus prompt package was delivered. The provision of lead

aprons, as reported by consumers, averaged 54% at Dental Office #2 during the normal routine. Two trained observers both reported not having

received lead shielding during this period. Immediately after delivery of the feedback plus prompt package, lead apron use, as reported by consumers, jumped to 100% and three trained observers at Dental Office #2 reported that they were given lead aprons during their X-ray exams. The provision of lead aprons remained at 100% during the follow-up period between weeks 44 and 48. A reduction in the provision of lead aprons (to 60%) was observed during the final follow-up assessment at the 59th and 60th wk.

Further demonstration of the effectiveness of the feedback packages is reflected by the results of the remaining target dental offices (Offices #3-#7). The provision of lead aprons at all these offices, as reported by consumers, increased from an average of 33.9% during normal routine to an average of 91.3% after delivery of the feedback/prompt packages. Furthermore, these improvements were maintained at 100% during the weeks subsequent to the delivery of the follow-up letter including the final assessment at the 59th and 60th wk.

Finally, these data, generated from the surveys of consumers, were verified during the numerous probes conducted by observers at each dental office during each phase of the experiment. A total of 29 probes were conducted at the eight dental offices. At those offices in which consumers reported almost never receiving the apron (e.g., Dental Office #5) during the normal routine, the observers also reported that no shielding was provided. At offices in which consumers' reports were highly variable, the observers' data were also variable (e.g., Offices #3 and #4). Only after delivery of the feedback packages did observers at all offices report the use of shielding. (However, Dental Office #6 had one observer who reported not getting an apron.)

At Dental Office #8, ultimately 75.5% of the customers reported receiving shielding during the normal routine. Thus the criterion (75%) required for delivery of the feedback commendation package was met and this office was sent

this package. Nevertheless, subsequent to the delivery of this package, consumers reported an even higher and more consistent provision of lead shielding (100%) through and including the follow-up period.

Collateral Behaviors and Observer Verification

The observer verification data pertaining to lead apron use and the three collateral behaviors are summarized in Figure 2. (The reports from the consumers' survey pertaining to the collateral behaviors are not reported here but correspond closely to the observers' data.) Lead apron provision rose from 31% (during the normal routine) to 92% during feedback phase. The reason (explanation) and price information data reflected very slight increases from 31% to 46%, and 6% to 15%, respectively. Figure 2 reflects no change in the third collateral behavior regarding whether the dental professional inquired as to when the patient was last X-rayed.

Social Evaluation

The results of the social evaluation questionnaire that dentists completed are presented in Table 1. Three of the seven target offices and eight out of nine nontarget offices (including Office #8) responded. In general, however, the responses from target and nontarget offices were similar on most items. Both groups, for example, were familiar with ADA's recommendation regarding apron use; both were equally satisfied with the manner in which the survey results were presented; and both were accepting of the involvement of IPIRG in the issue of consumer protection from X-rays.

However, the target dentists appeared to diminish the importance of providing shielding and were more skeptical regarding the accuracy of the survey results than were nontarget dentists. Finally, the target dentists rated the usefulness of the survey higher than did nontarget dentists (who presumably already knew they were providing aprons).

Due to the incomplete and small numbers of responses from the consumer activists, their ques-

Table 1
 Mean ratings and percent distribution of target (n = 3) and nontarget (n = 8) offices' responses to social evaluation questionnaire.

Questionnaire Item	Office Response (Mean Rating)	
	Yes	No
Prior to receiving the survey were you aware that the use of lead aprons during dental X-ray examinations has been recommended by various professional associations such as the ADA (American Dental Association)?	100 100	0 0
How important is it to provide lead aprons to patients during X-ray examinations?	-3- neither important nor unimportant 33.3 0	-2- unimportant
	-4- important	-1- totally unimportant
	-5- very important	
	0 75.0	0 0
	-3- neither useful nor useless 33.3 62.5	-2- useless
	-4- useful	-1- very useless
	66.7 25.0	0 0
	66.7 25.0	3.7 12.5
The results of the survey were:		Target (3.7) Nontarget (4.8)
		Target (3.7) Nontarget (3.0)

The manner in which the survey results were presented to you (through confidential written correspondence) was:

	-5- very satisfactory	-4- satisfactory	-3- neither satisfactory nor unsatis- factory	-2- unsatisfactory	-1- very unsatisfactory	Target (4.0) Nontarget (4.1)
	0 50.0	100 25.0	0 12.5	0 12.5	0 0	
Do you think the survey results were accurate?	-5- very accurate	-4- generally accurate	-3- neither accurate nor inaccurate	-2- generally inaccurate	-1- highly inaccurate	
	0 12.5	33.3 62.5	66.7 25.0	0 0	0 0	Target (3.3) Nontarget (3.9)

Did the survey results lead you to reexamine or alter the protocol you and your staff follow when administering X-rays?

	Yes	No	Not Answered	Target Nontarget
	33.3 0	33.3 100	33.3 0	

The idea of a citizen's group (PIRG) concerning themselves with dental and medical X-ray procedure is:

	-5- totally appropriate	-4- appropriate	-3- neither ap- propriate nor inappropriate	-2- inappropriate	-1- totally inappropriate	Target (4.0) Nontarget (4.0)
	0 25.0	100 50.0	0 25.0	0 0	0 0	
Did you decide to affix the peel-off stickers to the X-ray machine, power switch or other conspicuous place?	Yes	No	- not applicable -	Yes	No	Target Nontarget
	33.3	66.7		33.3	66.7	

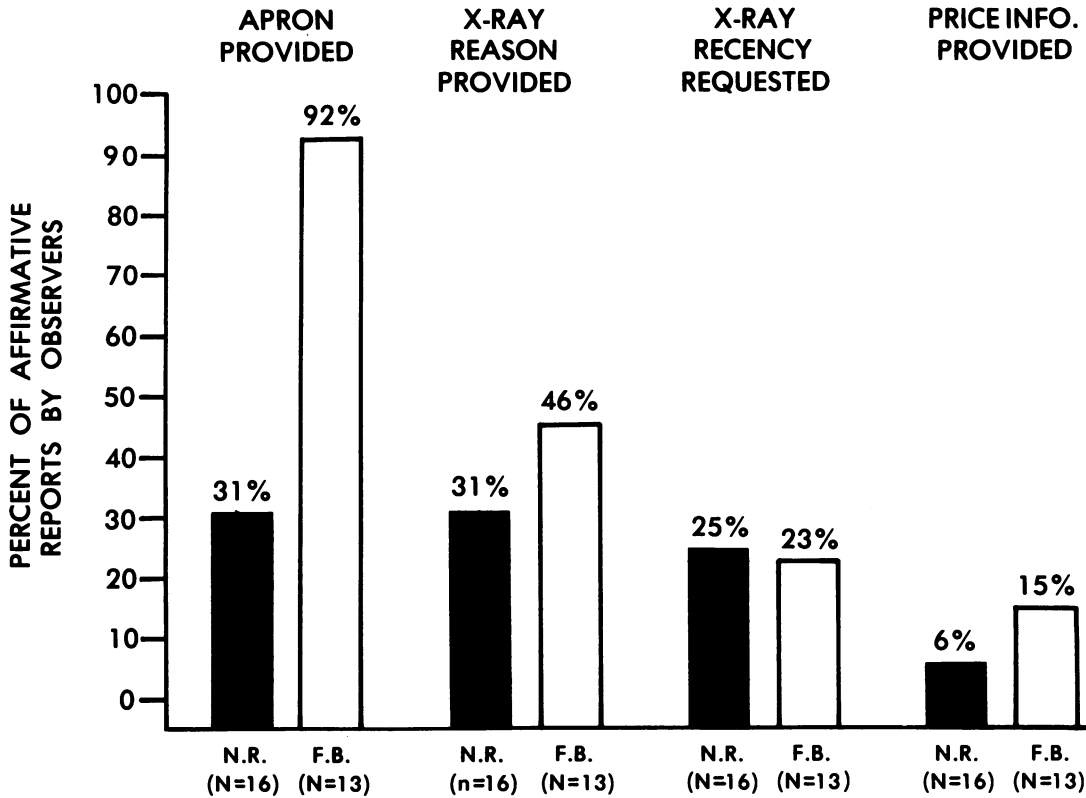


Fig. 2. Mean percentage of observers who reported the occurrence of each of the four target behaviors at all 8 dental offices during the normal routine (NR) and feedback (FB) phases.

tionnaire data have not been quantified. However, the responses that were obtained indicated a strong degree of concurrence with the importance of the issue and an acceptance of the methods for conducting the survey (i.e., recording license numbers).

DISCUSSION

The results of the study demonstrate that the feedback/prompt packages prepared by IPIRG and the Rehabilitation Institute were highly effective in increasing the regularity with which dental professionals provided lead shielding to consumers during X-ray examinations. The durability of the effects is remarkable considering that beyond the initial feedback/prompt package, additional feedback was provided only once with a follow-up contact.

A number of variables may have contributed to these significant and durable changes. First,

the fact that dentists were informed on the delivery of the initial feedback/prompt package that a follow-up survey would be presented may have resulted in a degree of observer "reactivity." (It is worth noting that to consumer groups, "reactivity" is not an artifact but an integral part of their efforts. This fact is connoted by the term "watchdog," which is often used to describe these groups.) This variable, however, probably can not account fully for the durability of the effect because apron use continued well beyond the follow-up contact. Moreover, even at Dental Office #8, which received only the feedback/commendation package with no statement regarding a follow-up report, there was a noticeable and sustained increase in the provision of lead aprons.

Apron use may also have been consistently occasioned by the stickers if these were displayed near the X-ray machine or power switch. Unfortunately, a generalized statement that all dental

professionals used these stickers is not possible, although one observer did notice them during his visit to Office #5. They may have been used at other offices but kept visible only to staff.

A third variable that may have contributed to sustained apron use is the relevance of the behavior (Ayllon & Azrin, 1968). That is, virtually every professional association concerned with radiography recommends providing consumers with lead shielding. It is also possible that providing aprons was reinforced by more natural contingencies. For example, perhaps dental professionals offered an explanation for providing shielding which customers responded to in a reinforcing manner. This possibility was suggested when the dentist at Office #5 told the first postintervention observer that an apron was being provided as a safeguard in response to a campus organization's request to protect consumers from radiation.

Finally, it is likely that the dentists shared the information in the feedback/prompt packages with their staff (e.g., hygienists) and prompted them to provide shielding to customers.

Additional research is needed to identify the components of the program that were essential to the behavior change. One practical question is whether comparable change could be obtained without providing feedback from surveys of consumers whose vehicles were identified in office parking lots. Although this survey procedure continuously generated an apparently reliable data base, its use in providing feedback may not be essential. Perhaps, for example, a survey of individuals from the telephone directory would provide an adequate data base for feedback; or, perhaps comparable results could be achieved without any feedback by simply reminding dental professionals of the hazards of X-rays and providing multiple prompts to occasion the use of shielding. For these reasons, it may be premature to conduct a cost-effectiveness analysis. That is, should the monitoring of license plates prove to be nonessential, then the costs of traveling to office sites would be spared. (In practical application this cost could

be reduced if feedback were based on fewer consumer responses, e.g., 15 per office, than used in this study.) Labor would also be reduced (although labor is volunteered by PIRGs).

In any event, a deliberate decision was made in the present study to provide both prompts and feedback based on the survey procedure. This decision was based on two important considerations. First, because the nature of the study was without precedent, it seemed reasonable to undertake an initial demonstration of a program that maximized the probability of behavior change (Yeaton, Greene, & Bailey, 1981). Second, considering the delicate nature of the feedback (which reflected the X-ray practices of health care professionals), the experimenters wanted to ensure that it was based on the most accurate and practical data base they could devise.

Indeed, throughout the study, great care was taken to ensure that all interactions with dental professionals were straightforward but courteous. Judging from the responses to the social evaluation questionnaire, it appears that dentists generally seem to have appreciated this effort. Most acknowledged the usefulness of the feedback and the appropriateness of consumer groups becoming involved with health care practices.

Additional comments from dentists, reflecting a range of viewpoints, were obtained when the senior author was contacted on occasion by phone. For example, the dentist at Office #1 (who did not respond to the questionnaire) expressed feeling "perturbed" by the information in the feedback/prompt package. He questioned the accuracy of the survey by asserting that his staff always provided lead shielding. (This assertion was repeatedly qualified as the conversation progressed.) It gradually became apparent that this dentist's real concern was with maintaining the confidentiality of the survey results and in being assured that other offices in the community would also receive similar feedback. In contrast, dentist (#2) indicated his appreciation of the survey which, he said, reminded his

staff of the importance of providing shielding.

Problems frequently encountered in community behavior analysis research were no strangers to this study. For example, extensive pilot testing of community-wide interventions is sometimes impractical without "spoiling" entire communities of subjects. Even the successive delivery of an intervention in multiple baseline fashion risks the possibility of diffusion or "spillover" of treatment. (The rationale for including dentists in two separate communities 8 miles apart and for gathering data on collateral, untreated behaviors was based on anticipation of spillover.) Such spillover may have occurred with the dentists who, like other professionals, probably exchange information at formal and informal occasions. Specifically, dentist (#1), in his conversation with the senior author, indicated that he had been in communication with some of his colleagues. It is not clear who the colleagues were or even if they were located in either of the two target communities. An examination of the data, however, suggests at least some possibility of spillover at Offices #3 and #4, although the variability of these data tempers this interpretation.

Finally, this study presents a model for incorporating the methodology of applied behavior analysis with the consumer advocate's objective of improving the quality of goods and services rendered by business and government. The alliance is characterized by a certain quality of countercontrol. As Skinner (1971) points out, countercontrol is weak and the prospects of abuse are great in systems in which the control of important reinforcers is delegated or abdicated. Such is the case in the health care system where citizens have abdicated control over their own well being to professionals, many of whom reinforce this deference by resisting consumers' scrutiny or questioning of their practices. Therefore, the utility in the alliance between behavior analysis and consumer advocacy may rest with the fact that a formidable basis is established for exercising countercontrol—an essential element of the social contract.

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