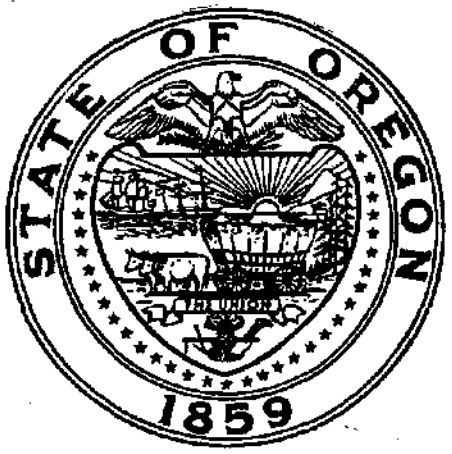
EVALUATION OF MULTIUOMAH COUNTY'S COMMERCIAL BURGLARY PREVENTION PROJECT

Prepared By The

Oregon Law Enforcement Council

EVALUATION OF MULTNOMAH COUNTY'S COMMERCIAL BURGLARY PREVENTION PROJECT

March 1980



Victor Atiyeh
Governor

James Brown
Chairman
Oregon Law Enforcement Council

Keith A. Stubblefield
Administrator
Oregon Law Enforcement Council

Prepared under Grants 77 A 2.1 and 79 A 253.1 from the U. S. Department of Justice, Law Enforcement Assistance Administration, and the Oregon Law Enforcement Council.

EVALUATION OF MULTNOMAH COUNTY'S COMMERCIAL BURGLARY PREVENTION PROGRAM

Principal Researcher and Author:

Dennis A. Pearson
Evaluation Researcher
Evaluation and Research Unit
Oregon Law Enforcement Council (OLEC)

ACKNOWLEDGMENTS

Appreciation is extended to the following individuals for their cooperation, assistance and support in conducting this evaluation and in the preparation of this report.

Sgt. Richard Orazetti, Director, Multnomah County Crime Prevention Unit.

Deputy John Drum, Assistant Director, Multnomah County Crime Prevention Unit.

Bill Goss, past Director of Multnomah County Crime Prevention Unit.

Steve Watts, currently Support Services Manager for Multnomah County Department of Corrections.

Jack Bails, Director, Criminal Justice Planning Unit Metropolitan Service District

Appreciation is also extended to Anne Schneider of the Institute of Policy Analysis, as well as Clinton Goff and Dick Jones of OLEC for their insight and technical assistance in the design and data analysis phases of this project.

Information regarding this study or copies of this or related reports can be obtained by writing or calling the following individuals:

Dennis Pearson
Researcher
(503) 378-4236

or

Clinton Goff
Evaluation and Research Unit Supervisor
(503) 378-4359

Oregon Law Enforcement Council
2001 Front Street N.E.
Salem, Oregon 97310

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Program Background and Evaluation Design

Between July , 197, and June 3, 1978, the Multnomah County Department of Public Safety's Crime Prevention Unit conducted nearly 500 commercial premise security surveys.

Each participating business was contacted by a Multnomah County Deputy, who completed, in the presence of the business owner or manager, a thorough internal and external security assessment. A few days after the survey, a report of the premise inspection was mailed to each participant. This report listed the specific corrections the inspecting deputy determined were necessary to decrease each business's vulnerability to burglary.

Approximately six months after the premise survey, every surveyed business was telephoned to determine the degree of compliance to each of the security recommendations. The major assumption of this and all other target hardening projects is that compliance with the security suggestions will result in a significant decrease in the risk of burglary.

This evaluation was completed to measure the effect of the survey on a sample of 435 program participants and 225 non-surveyed Control businesses. Specifically, this report will answer the following primary questions:

1. Was there a statistically significant reduction in the incidence of reported burglary for program recipients over a one-year pre-program and one-year post-program period?*

---

[1] If two sets of values are significantly different, this means that there is a five percent or less probability ($p^{\wedge}.05$) that the difference is due to chance alone.

2. Was there a statistically significant reduction in the incidence of reported burglary for those businesses having high rates of compliance over the same one-year pre- and one-year post-program period?

In addition to the above essential questions, a secondary concern is the effect the program has had on county-wide commercial burglaries. Two questions were answered:

1. Since the start of the program has there been a statistically significant change in the monthly incidence of county-wide commercial burglaries?

2. Has there been a statistically significant change over the same time period in the monthly incidence of commercial burglary in an adjacent county— one not having a formal commercial premise inspection program?

EVALUATION FINDINGS

1. A large portion of the Target group and the Control group businesses were chosen from all businesses burglarized at least once during the one-or-two month period prior to the survey. This selection rule caused these two groups to have unusually high average burglary rates, which if not corrected would result in a highly significant decrease in post-period burglaries regardless of the type and extent of intervention. This natural statistical regression was accounted for and treated by removing the selection crime from both the high risk Target group(N-198) and high risk Control group (N=225).

   After removing the selection crime, there were 18 percent fewer burglaries per business in the Target group than in the Control group during the one-year post-period. This difference, while not statistically significant, demonstrates a practically significant reduction in burglary risk.

A time-series analysis (month-to-month trend) of the Target group's burglary totals demonstrated a statistically significant decrease in the target's post-survey trend. The Control group's trend was not significantly different from that of the pre-period.

The first finding, a nonsignificant difference in post-survey burglaries, resulted from a simple comparison of the group averages and the individual business burglary totals for two points in time (one pre-average or total and one post-average or total. On the other hand, the time-series analysis compared the month-to-month change in the trend of the reported burglaries. Time-series analysis gives a more realistic and conclusive assessment of project impact since all of the crimes do not occur at the same time during the pre- and post-periods; instead, they are distributed over time. Secondly, since it has been demonstrated in other studies that there is sometimes a cumulative and delayed compliance effect, the pattern of the month-to-month burglaries can be expected to decrease as time elapses.

2, A group of 27 businesses that complied with 76% to 100% of their survey recommendations were isolated and compared with the Control group. The average number of burglaries per business in the high compliance and the Control samples were equivalent during the pre-period. However, during the post-period the Control group's burglary average was 97.6 percent greater than the high compliance group's average (.328 vs. .166 burglaries per business). However, due to the relatively small number of businesses in the high compliance group and high variance in the number of burglaries within both groups, this difference approached, but did not attain, statistical significance (p=.O68). Although this decline in the high compliance group did not quite reach statistical significance, few would disagree that a 97.6 percent difference is certainly of practical significance.

3. A time-series comparison of the county-wide monthly commercial burglary totals revealed that Multnomah County's monthly totals declined at a rate statistically similar to its pre-program period.

4. A time-series analysis of the monthly burglary totals for a Control county (Ciackamas County) illustrated a nearly significant increase in its post-period trend.2 (p =>.O5 and^.10)

Conclusion: Has there been a significant reduction in the incidence of burglary in the Target businesses? Yes.

Taken together these findings demonstrate that the premise survey program has significantly reduced the burglary trend within the Target group. (See Finding 1) The positive impact of the program is further supported by a lack of a significant trend reduction in the Control group. Although no change occurred in the average number of post-period burglaries within the Target group there was a nearly significant (p= .068) decrease in the average number of burglaries within a group of high compliance businesses.

The county-wide time-series demonstrated that Multnomah County has experienced a statistically insignificant decline, while a county not having a formal commercial premise program (Ciackamas County) has had a nearly significant increase during the 27 months since the beginning of the premise survey program. Although the Target group has demonstrated a significant reduction in its post-survey trend, it cannot be concluded that Multnomah County's jurisdiction-wide relative rate of decrease was due solely to the premise survey, only that the surveys have been a contributor to the downward trend. Multnomah County has also had a Major Violator Program in operation since October 1976, which has sucessfully prosecuted several hundred repeat burglary offenders. This program has likely been a contributor to the leveling of Multnomah County's commercial burglary rate.

2. Although Ciackamas County has not had a commercial premise survey program there has been an intensive burglary prosecution project in operation in Ciackamas County since 1974. This joint venture between the Ciackamas County District Attorney's Office and the Ciackamas County Sheriff's Office, was federally funded from July 1, 1974, through June 1978. It has continued to operate under local funding since July 1978.

I. INTRODUCTION AND PROJECT BACKGROUND

During the fiscal years 1974, 1975 and 1976, Multnomah County Department of Public Safety received Law Enforcement Assistance Administration (LEAA), state and local funding to provide a "Community Crime Prevention and Education" Program for the citizens of Multnomah County. Project activities included presentation of public block meetings, property marking, school crime prevention presentations, consultation with businessmen regarding commercial crime prevention, and provision for a mobile trailer crime prevention display center. In addition, a highly successful alarm ordinance program was implemented, resulting in a 47,3 percent reduction in the County's false alarm rate between 1975 and 1976.

During these first three years of operation little emphasis was placed on commercial security surveys. A total of 67 residential and commercial security surveys were conducted over this time period. These surveys were not initiated by the Multnomah County Crime Prevention Unit (MCCPU), but were given in response to requests from residents and businessmen. However, largely because of a 43 percent rise in reported commercial burglary and a 24 percent decline in the incidence of reported residential burglary between calendar years 1973 and 1976, it was decided to begin an organized commercial security inspection program on July 1, 1977 (the beginning of the project's FY 1977 grant year). This date also marked the beginning of MCCPU's entry into the interagency crime prevention program involving Multnomah County, the Port of Portland and the cities of Gresham and Troutdale.

The collective, interagency goals for this project during the first year of operation were:

1. A reduction of 2 percent in the incidence of residential burglary in the grant year.

2. A reduction of 6 percent in the incidence of commercial burglary in the grant year.

3. An increase of 10 percent in the reporting of rape in the grant year.

4. A decrease of 10 percent in the incidence of rape in the grant year.

5. An increase of 10 percent in police contact with institutions, planners, architects and builders in the grant year.

6. Development of specific action plans to combat terrorism and transportation crimes at Portland International Airport.

Specific activities projected for MCCPU the first year included conducting 500 commercial burglary premises surveys. These surveys were to provide 500 nonresidential establishments (including schools and churches) with a thorough, internal and external assessment of physical security strengths and weaknesses. Written inspection reports and detailed suggestions to improve physical security were to be mailed to each participant. A phone interview was then to be conducted approximately six months after the premise inspections to measure compliance with each of the suggested improvements. It was expected that compliance with the security suggestions made in these inspection reports would decrease the participants' vulnerability to burglary. This evaluation report will test that assumption.

The specific hypothesis being tested is that:

Over a one-year pre-survey and a one-year post-survey time period, there will be a statistically significant decrease in the incidence of reported commercial burglary in those commercial establishments receiving the security survey.

*

To insure that a reasonably conclusive evaluation be carried out the MCCPU contracted with a local research firm for the purpose of having them design a method of determining project impact.

In June of 1977, Marlene A. Young Rifai of Applied Systems Research and Development completed the evaluation design. (See Bibliography entry 8) This design served as the guide for data collection over the duration of the first year (1977-78) of the project.

In October of 1978 the Oregon Law Enforcement Council (OLEC) was approached by the MCCPU and the criminal justice planner for District 2 with a request to analyze the data gathered from those businesses surveyed during FY 1977. Prior to that time OLEC was not directly involved in the evaluation. After conferring with project and planning staff, it was decided that a total of $5,860 in project funds would be made available for data collection, coding data, analysis and report preparation and printing. OLEC would, in turn, provide the personnel costs of one researcher on a part-time basis for the data analysis and report preparation.

II. EVALUATION DESIGN AND SAMPLE

The original design envisioned by Applied Systems Research and Development called for two levels of evaluation. The first would consist of a one-group interrupted time series design which would compare the incidence of commercial burglary prior to receiving the premise surveys with a period of time after the survey. No Control or comparison group was mentioned in this phase. This phase was to be based on two years of pre-survey victimization data gathered at the time of the survey and six months of post-survey victimization data collected at the time of the compliance follow up survey. (See Preliminary and Followup Questionnaire in Appendix D).

The second level was to consist of a multiple time series comparison of county-wide commercial burglary rates with those of a nonequivalent comparison county. Pre-survey and post-survey rates of reported burglary would then be compared and comparisons made in the trend and level of crime incidence over time. It was suggested that Clackamas or Washington County, Oregon or Clark County, Washington, be used as the nonequivalent comparison county.

Because of a lack of compatability in the time periods used by the victimization data (2 years pre- versus six months post-survey) and the questionable validity of using a two-year reference period, plus numerous instances of an inability for participants to recall the month of victimizations (an essential requirement of the proposed time series analysis), it was decided to use reported burglaries as the primary criterion] Hy measure. This decision is further supported by the repeated indication from national victimization surveys that commercial burglary has, primarily because of insurance requirements, one of the highest reporting rates of any crime (11). Therefore, the potential for the confounding factor of increased reporting as a result of the premise surveys is minimized in the evaluation of this program. The data gathered from the preliminary and follow-up questionnaires were, nonetheless, recorded but became of secondary importance to the reported crime data.

Because of the fact that only 400-500 businesses were to be contacted during the first year of project operations, it would seem unlikely that a significant decline in county-wide commercial burglaries would occur, considering that this number of businesses represents only 10 to 15 percent of the total commercial entities in unincorporated Multnomah County. However, data on the incidence and reported property loss of monthly commercial burglaries were gathered for Multnomah County and for Clackamas County for the period of January 1976 through September 1979, to determine any pre/post change in burglary rates. Clackamas County was chosen as a comparison group because it has not had a formal commercial premise survey program in operation prior to or during MCCPUs program. This nonequivalent, multiple time series data will be presented but will not constitute the primary measure of project impact. The central measure of project effectiveness will be the comparison of pre/post survey burglary frequency for those receiving the surveys and for a comparable group of nonsurveyed businesses.

Figure 1 lists the two impact hypotheses being tested in this evaluation. Although the project's stated outcome objective is a 6 percent decrease in county-wide commercial burglary incidents, it was decided to amend this objective for the purposes of this evaluation. This change was made since it is necessary to establish the causal relationship, if any, between the program and those directly participating in it before any indirect, jurisdiction-wide benefit can be attributed to the premise security program.

Figure 1

Evaluation Design:
Hypotheses and Statistical Tests

Hypothesis 1:	Over a one-year pre-program and a one-year post-program period, there will be a statistically significant decrease in the incidence of reported burglary for program participants.
Design:	Two-group pre/post experimental (Target) vs. Control and multiple time series analysis.
Tests:	T-test, repeated measures analysis of variance and time series analysis of burglaries for 435 Target and 225 Control businesses.
Hypothesis 2:	Over a one-year pre-program and a one-year post-program period there will be a statistically significant decrease in the incidence of reported burglary for those businesses having high rates of compliance.
Design:	Two-group pre/post experimental Target vs. Control.[a]
Test:	T-test of high compliance group's burglary average compared to the Control group's average.[a]

[a] There are insufficient businesses and burglaries in the high compliance group (N=27) to conduct a time series analysis of this hypothesis. In addition, because of the discrepancy in the sample sizes between the high compliance Target group (N=27) and the Control group (N=225), analysis of variance was not used to test Hypothesis 2.

The Sample

The project staff used a stratified quota sampling technique to select a total of 435 businesses as survey recipients. This Target sample was chosen using two methods. Approximately half of the total of 435 businesses (N=198) were businesses which had reported at least one burglary within a one- or two-month period prior to receiving the premise survey. The remainder of the Target group (N=237) was chosen from a complete listing of Multnomah County's Personal Assessment Tax Roll using a stratified random sampling technique. Both groups were selected so that a total of 497 businesses were surveyed between July 1, 1977, and June 30, 1978. However, only 435 had complete survey and compliance data available at the time of initial data collection.

These businesses and institutions were representative of the total commercial and nonresidential establishments (schools and churches included) in unincorporated Multnomah County by type of business and team policing area. Table 1 describes the total Target sample (N=435) by the number and proportion expected by team area and the number and proportion actually obtained.

No Control group was chosen at the time the surveys were being conducted. If no comparison group had been selected, a simple pre/post comparison of the Target group's burglary incidents would have yielded a weak and inconclusive measure of impact since there would not have been a comparable group of businesses that did not receive the premise survey to measure the effect of the program. To eliminate this problem a comparison group of 225 businesses was chosen using a stratified random sampling method from the remaining pool of businesses victimized at least once during the survey period (July 1, 1977, through June 30, 1978).

TABLE ia

Target Sample: Expected and Obtained
Proportion by Team Area
(N=435)

	Expected Number of Businesses		Obtained Number of Businesses	
	N	%	N	*
Team 1	26	6*	32	7.3*
Team 2	100	23*	113	25.9*
Team 3	148	34*	155	35.6*
Team 4	78	18*	69	15.8*
Team 5	83	19*	67	15,4*
	435	TOT	436a	100.0%

If $\chi^2 = 3.83$, 4 d.f., no statistically significant difference between expected and observed frequency of businesses.

e

[a]The Target and Control samples were weighted so that they would be more closely representative of the proportions of businesses within each team area and business type. Because of this, the total number of obtained businesses may vary slightly (+1 or -1).

Table 2 lists the proportion and number expected and observed within the Target sample by business type.'

TABLE 2

Target Sample: Expected and Obtained
Proportion by Business Type
(N=435)

	Expected Number of Businesses		Obtained Number of Businesses	
	N	%	N	%
Schools	9	2.1%	10	2.3%
Gas/Repair Stations	17	3.9%	17	3.9%
Churches	13	2.9%	13	3.0%
Restaurants	26	5.9%	26	6.0%
Taverns	10	2.4%	11	2.5%
Warehouse	32	7.4%	33	7.5%
Grocery/Variety	18	4.1%	18	4.1%
Drug Store	1	.3%	2	.5%
Doctor's Offices	32	7.3%	31	7.1%
Business Offices	154	35.5%	155	35.7%
Clothing Store	10	2.3%	9	2.1%
Retail Stores	91	20.9%	90	20.7%
Miscellaneous	21	4.8%	20	4.6%
TOTAL	434	100.0%	435	100.0%

X^2 = 0.55, 12 d.f., no statistically significant difference in the expected and obtained frequency of businesses.

Tables 3 and 4 describe the Control group by the number and proportion of businesses expected and actually obtained by team area and business type, respectively.

TABLE 3

Control Sample: Expected and Obtained
Proportion by Team Area[3]
(N-225)

	Expected Number and Percent of Businesses		Obtained Number and Percent of Business	
	N	%	N	%
Team 1	14	6%	10	4.4%
Team 2	52	23%	60	26.5%
Team 3	76	34*	61	27.3%
Team 4	40	18%	50	22.2%
Team 5	43	19%	44	19.6%
TOTAL	225	100%	225	100.0%

X^2 - 3.49, 4 d.f., no statistically significant difference between the expected and obtained distribution of businesses.

[a] The Target and Control samples were weighted so that they will be more closely representative of the actual proportion of businesses by team area and business type. Because of this, the total number of cases may *vary* slightly (+1 or -1).

TABLE 4

Control Sample: Expected and Obtained Proportion by Business Type (N=225)

	Expected Number of Businesses		Obtained Number of Businesses	
	N	%	N	%
Schools	5	2.1%	5	2.2%
Gas/Repair Stations	9	3.9%	9	4.0%
Churches	7	2.9%	7	3.1%
Restaurants	13	5.9%	14	6.2%
Taverns	5	2.4%	6	2.7%
Warehouses	17	7.4%	17	7.6%
Grocery/Variety	9	4.1%	9	4.0%
Drug Store	1	.3%	0	0
Doctors Offices	16	7.3%	17	7.6%
Business Offices	80	35.5%	82	36.4%
Clothing Stores	5	2.3%	0	0
Retail Stores	47	20.9%	48	21.3%
Miscellaneous	11	4.8	11	4.9%
TOTAL	225	100.0%	225	100.0%

X^2 = 5.19, 12 d.f., no statistically significant difference between the expected and obtained distribution of businesses.

Comparisons were made between the expected sample and the sample actually obtained. The results of this analysis confirmed that there are no significant differences between the statified sample expected and the obtained sample. This finding demonstrates that both the Target and Comparison groups are equivalent in terms of their geographic distribution and business type.

To complete the process of determining Target-Comparison group equivalence, the average (mean) number of burglaries occurring in the Target and Control group businesses for one year prior to the survey were compared.2 No significant difference was found between the average number of burglaries occurring within the Target and comparison groups. This finding, in addition to the similarity of the two samples' geographic and business type distributions, provides significant evidence that the two groups were equivalent on several relevant factors prior to the intervention of the premises surveys. Any comparisons between the burglary rates of these two samples will, therefore, reflect more conclusively the effect of the survey on the risk of subsequent victimization.

If the Target and Control groups were significantly different, particularly in terms of pre-survey burglary rates, it would be difficult to attribute any observed change in burglary risk to the effect of the commercial crime prevention program.

---

[2] z = .389, 433 d.f., not statistically significant. This test was made between the mean burglary frequency of the Target and Control groups after removing that burglary that got each business into the sample. This was done for both the Target and Control samples to correct for an extreme statistical regression effect caused by selecting only those businesses having been burglarized at least once. See Appendix A.

III. DATA ANALYSIS AND FINDINGS

1. Total Sample Analysis

Three methods were used to analyze the pre/post burglary frequency. These were:

1) Comparison of the average (mean) number of burglaries reported by each business twelve months prior to the survey and twelve months after the survey.

2) A repeated measures analysis of variance of pre/post reported burglaries.

3) A Walker-Lev time series analysis of pre/post reported burglaries.

The results of these analyses are presented below:

A. Pre/Post Comparison of Burglary Averages

The comparison of the Target group's pre and post average values resulted in an insignificant increase in burglaries (See Table 5). The same test applied to pre/post Control group mean burglaries also resulted in a statistically insignificant increase in burglaries over the two-year comparison period.[3] However, a more central test of the effect of the surveys is not the pre/post comparison within groups (Target versus Target, Control versus Control), but the between groups difference (Target versus Control), in post-survey average burglaries. This comparison is:

[3] The power of the z statistic tp reject the hypothesis that there is no difference in the mean burglary rates is strongly affected by the variability in the data. Both the Target and Control groups have relatively large variance in their burglary rates. Had their respective variances been smaller, there may well have been a significant difference, particularly between the pre/post Control group means.

Target Post Period[a]		Control Post Period[a]	Significance
JT = .301 Burglaries		*f* =.328 Burglaries	Z = .462
VAR = .549	vs.	VAR = .484	N.S.
S.D. = .741		S. D. «.696	p = .32

[a] $\bar{X}$ = Average (Mean]) S.D. = Standard Deviation VAR = Variance

This comparison shows that there was an insignificantly higher mean burglary rate in the Control group post period over that of the Target group post period ($\bar{X}$ Control = .328, $\bar{X}$ Target = .301). This result indicates that there is a statistically insignificant advantage in being in the Target group. Table 5 indicates there is an 18 percent difference in the post-period percentage increase (22 percent Control versus 3.9 percent Target) between the Control and Target groups' total burglaries. In other words, while the number of post-period burglaries increased by over one-fifth in the Control group (22 percent), there was only an increase of one twenty-fifth (3.9 percent) in the Target group's burglary rate over the two-year comparison period.

TABLE 5

PRE/POST BURGLARY FREQUENCY

Group	Pre-Survey Burglaries	Post Survey Burglaries	Percent Change	Significance (1-tailed)
Target Group	Total = 128	Total = 133	+3.9%	*z* = .165
	Average = .294	Average = .301		N.S.
(N - 435)				p = .43
Control Group	Total = 59	Total * 72	+22.0#	z = 1.06
	Average = .271	Average = .328		N.S.
(N=225)				p = .15

B. Analysis of Variance of Pre/Post Burglaries

A repeated measures analysis of variance* was applied to the pre/post Target and Control group. Three separate analyses were done:

a. Analysis of variance (difference) in the pre and post burglaries in the total Target and Control groups.

b. Analysis of variance in the pre and post burglaries for high risk Target and Control businesses.

c. Analysis of variance in the pre and post burglaries for low risk Target and Control businesses.

Appendix B contains the analysis of variance summary tables for each of these three analyses.

* 2 x 2 (Groups by time periods) unweighted means solution for unequal group size.

The results of the first analysis indicated that there is no significant difference between the Target and Control groups' burglary rates between groups and/or between time periods. This indicates that overall, neither the survey nor the passage of time produced any statistically significant changes in the pre and post burglary frequency for either the Control or Target sample. (See Appendix B, Table B-l, for analysis results.)

This data also indicates there is a tendency for those businesses in both the Target and Control groups that experienced high numbers of burglaries during the pre-survey[4] period to have generally lower numbers of burglaries during the post-survey period.

Likewise, the opposite effect seemed to be occurring in those businesses that were the victims of relatively few pre-survey[4] burglaries. In this low risk group there was an increase in their respective post-survey burglary rates.

To test this phenomenon, a high risk group composed of businesses with two or more pre-survey burglaries and a low risk group of those having one or no pre-survey burglaries were separated into two analyses of variance. (See Appendix B, Tables B-2 and B-3, for the summary tables and the individual significance tests.)

The analysis of the high risk groups resulted in an overall significant decline in the mean number of burglaries for both the Target and the Control group businesses between the pre and post time periods. ($F = 51.65$, d.f.l, 114, $p<.001$). But again, there was no difference between the Target and Control groups' burglary frequency. That is, there was no significant advantage in being in either group.

[4] Pre-survey in the case of the Target group and pre-origin crime in the case of the Control businesses. Because the Control businesses did not receive a survey, the date of the crime that was used to select each Control group business was used as the pre-post period dividing point.

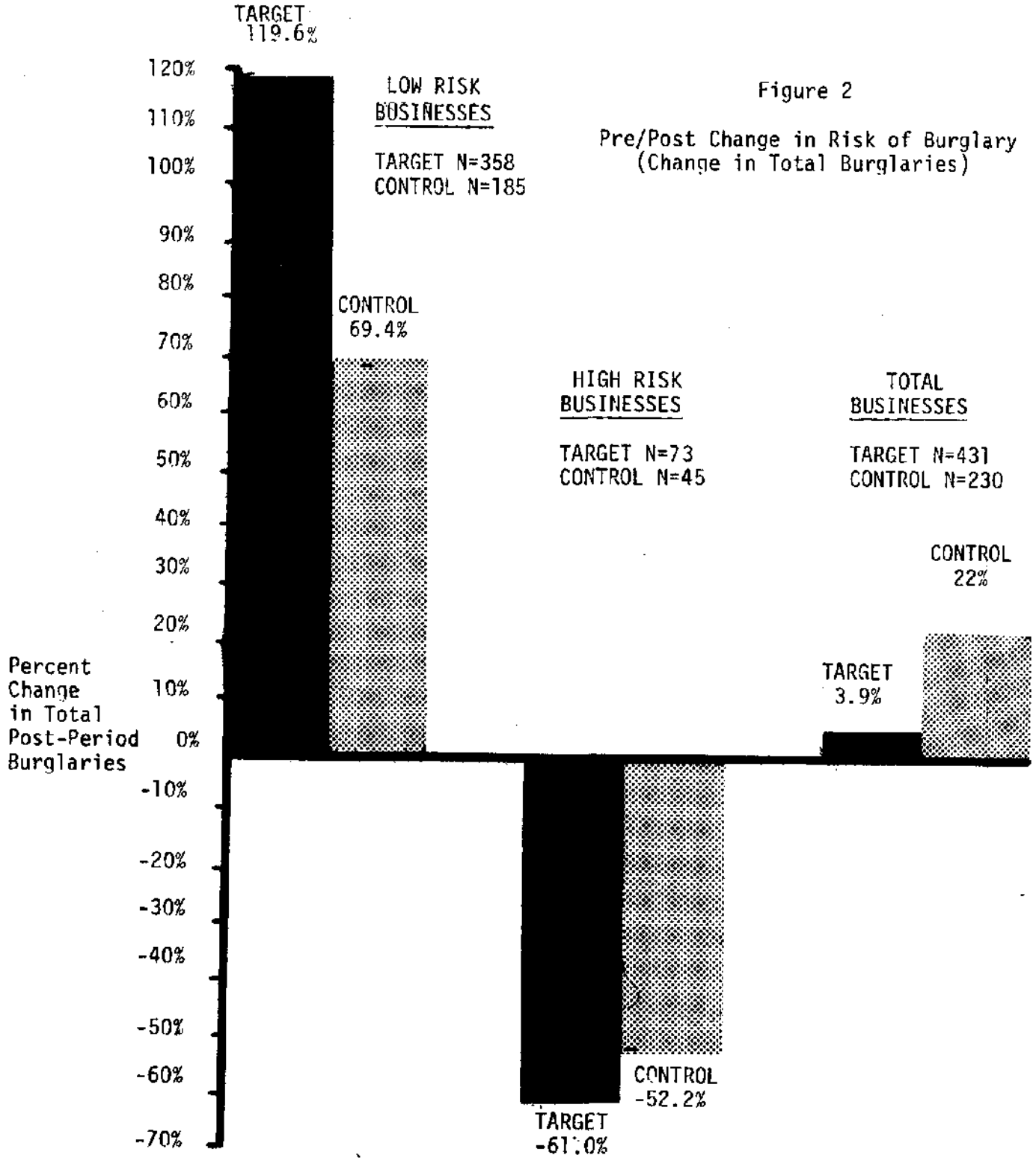


Figure 2

Pre/Post Change in Risk of Burglary
(Change in Total Burglaries)

The above figure is based on the following change in post burglary frequenc
(All pre-period totals have had the selection burglary removed to correct fo
the selection bias, see Appendix A):

	Pre-Burglaries	Post-Burglaries	% Chan
Low Risk Target	46	101	119.6%
High Risk Target	82	32	-61.0%
Total Target Group	128	133	3.9%
Low Risk Control	36	61	69.4%
High Risk Target	23	11	-52.2%
Total Control Group	59	72	22.0%

the low risk group analysis indicates a significant rise in the rate of burglary over the pre/post time period for both the Target and Control groups. Graphically, what has occurred between the pre and post-time periods for the overall sample and for each of the two risk groups is shown in Figure 2.

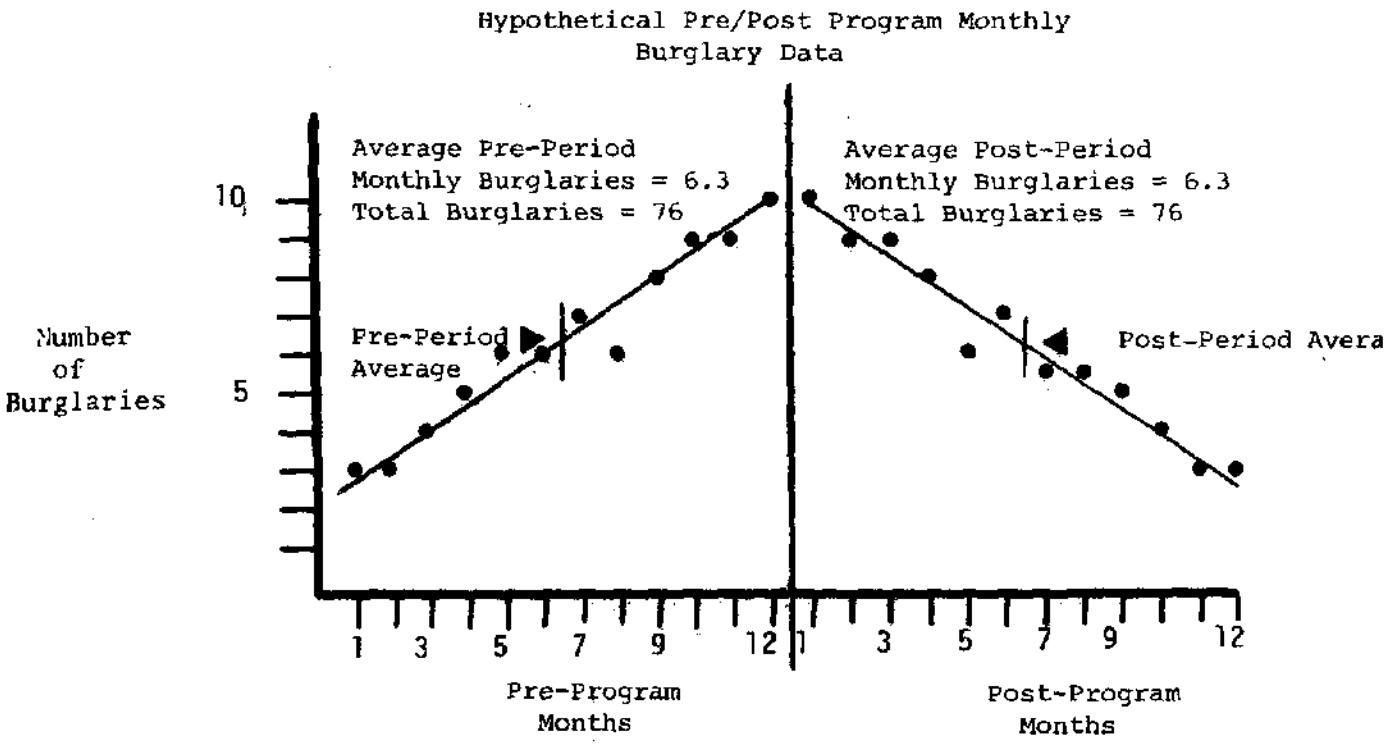
Figure *1* illustrates a common phenomenon—statistical regression. That is, in this instance, those businesses having relatively low rates of burglary prior to the survey experienced more burglaries during the post period. Likewise, those having relatively high rates of pre-survey burglaries had lower rates during the post period. In other words, each risk group "regressed" toward their individual group means, or average, over time. The net effect of these countervailing trends is the slight (statistically insignificant) rise in the number of burglaries over the two-year pre/post period for both the Target and the Control groups.

C. Walker-Lev Time Series Analysis of Pre/Post Burglaries

To this point in the evaluation the tests used to measure the effect of the survey of burglary risk have treated the pre and post totals and averages for the Target and Control businesses as though they occurred at only two points in time; one pre total (or average) and one post total (or average). This perspective is narrow because it does not take into account the distribution of burglaries over time. Since it had been demonstrated in past crime prevention studies that the effects of Target hardening measures are sometimes delayed and cummulative, it follows that there might be a gradual downward trend in the Target group as time passes. Such a trend could be masked when simply looking at group totals or averages. This post survey declining pattern can best be described with an example.

Figure 3 depicts the monthly burglary totals in a fictitious but conceivable crime prevention program. As can be seen, the pre- and post- totals, and average burglaries are identical. Therefore, the standard tests of significance between means and repeated measures analysis of variance would be unable to demonstrate any difference in the monthly pre/post burglary totals.

FIGURE 3


Hypothetical Pre/Post Program Monthly Burglary Data
Average Pre-Period Monthly Burglaries = 6.3
Total Burglaries = 76
Average Post-Period Monthly Burglaries = 6.3
Total Burglaries = 76
Pre-Period Average
Post-Period Avera
Number of Burglaries
10
5
1 3 5 7 9 12
1 3 5 7 9 12
Pre-Program Months
Post-Program Months

However, it can be easily seen that there has been a very definite downward trend in the monthly burglaries that began immediately following the point of intervention. Unless these monthly totals were plotted, this gradual but steady change in the burglary trend may not have been noticed and an important outcome of the program could have been overlooked.

With the Target and Control businesses' monthly burglary totals plotted by pre- and post-period months, a multiple time series design is formed. This design compares the change in the slope (upward or downward trend) and the level (overall horizontal height of the trend) of the pre- and post monthly burglary incidents for a Target and Control group. There are several methods currently employed to test the significance of change between pre- and post-trends. The method used to test for post-survey change in burglary incidents for this evaluation was a series of three tests based upon analysis of co-variance and ordinary least squares regression discontinuity techniques.

The first test, Walker-Lev 1, compared the regression slope for the pre-survey data with the slope for the post-survey time period. A significant test result indicates that a change in slope has occurred which is greater than that expected by chance alone. A significant result from the second test, Walker-Lev 2, demonstrates that the trend for the entire regression line of the pre/post time series is significantly different from zero. Finally, Walker-Lev 3 determines whether or not there has been a significant shift in the level (intercept) of the pre- and post-survey burglary incidents.[5]

When the monthly burglary totals are plotted by month for the Target group (See Figure 4) a definite downward trend in the post-period incidence of burglary is evident. To correct for the bias in the selection of nearly half of the total Target sample (198 of 435) the pre-survey trend is based on the first through the tenth pre-survey month for each business. To include the totals for months eleven and twelve would result in an automatic significant decline in burglary frequency simply due to statistical regession (See Figure A-l).

5 For a basic description of the Walker-Lev and other time series techniques see Anne Schneider's (et al.) Handbook of Resources for Criminal Justice Evaluators, pp 2-39 to 2-115. See bibliographic entry 9.

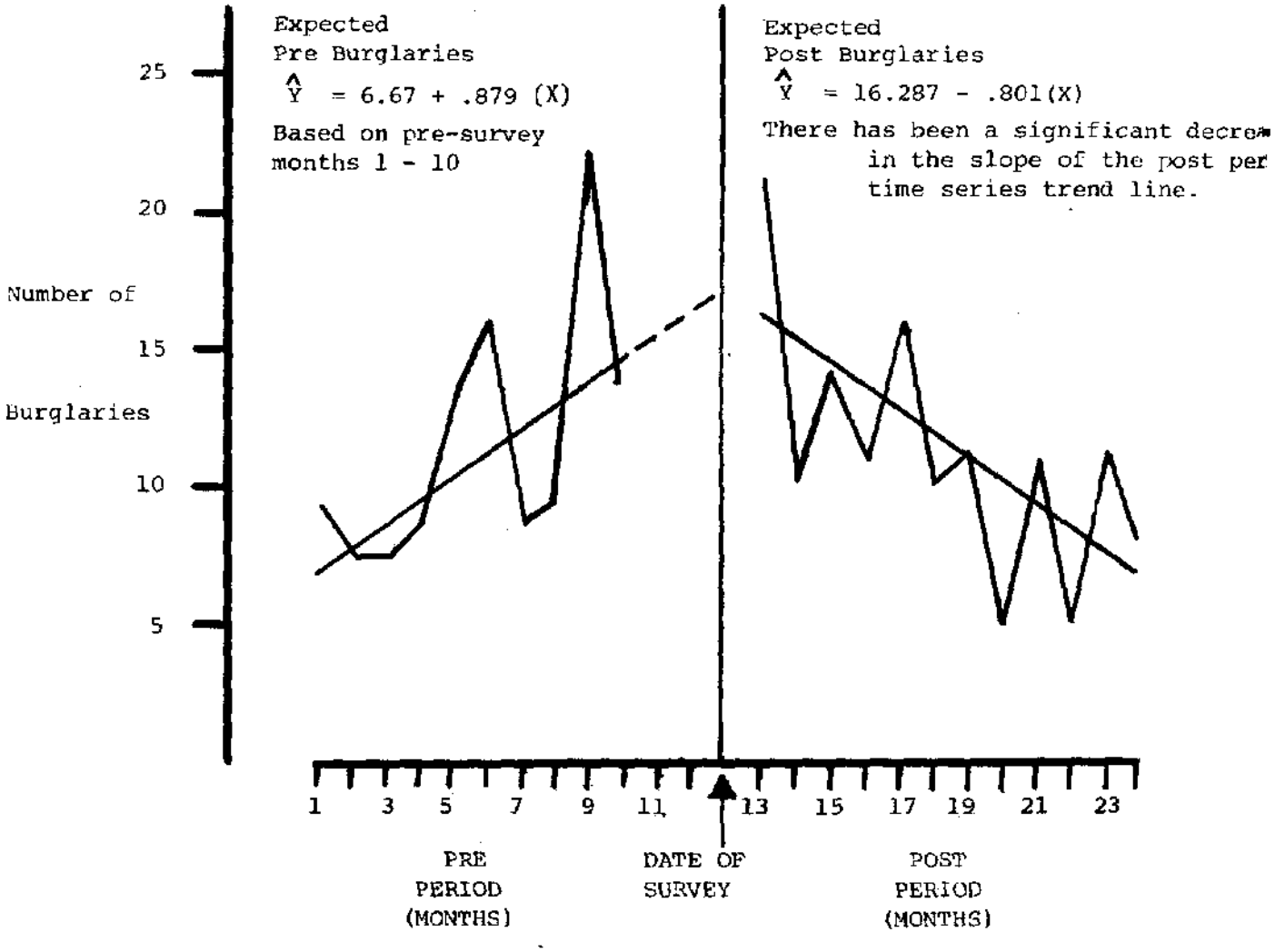
Figure 4

Pre/Post Montly Burglary Frequency
In Target Group
(N = 435)

Time Series
Analysis Results:

Walker-Lev 1	F = 9.765,	1, 18 d.f.,	p = $<$.01
Walker-Lev 2	F = .336,	1, 18 d.f.,	N.S.*
Walker-Lev 3	F = .168,	1, 19 d.f.,	N.S.*
Double Mood	T = 0.0 ,	18 d.f.,	N.S.*
Single Mood	T = -.90 ,	8 d.f.,	N.S.*

* not statistically significant



When the Walker-Lev analysis was applied to the Target group's monthly burglary totals, using months one through ten of the pre-survey period and all 12 post-survey months, a statistically significant difference was found in the trend line (slope) of the two time periods. The significant Walker Lev 1 test shows that the downward slope of the post-survey burglaries is significantly different from the upward pre-survey trend.[6] Therefore, it can be concluded that there was a significant decrease in the total target group's burglary trend after receiving the premise survey. No significant change in the level of the time series was found. (Walker-Lev 3: F = .168, 1, 19 d.f., not statistically significant).

Figure 5 describes the pre/post monthly burglary totals for the Control group. Since the Control group's point of intervention is the date of the "original crime" not the date of the survey (no survey was given to the Control group), it is more straightforward to correct for the selection bias for this group than for the Target group. All original crimes (the point of intervention for the Control Group) were removed from the time series analysis, leaving twelve months of unbiased, pre-period burglaries and twelve months of unbiased post-period burglaries.

None of the Walker-Lev time series test showed any significant change in either the trend (slope) or level (intercept) of the Control group's post-period burglary frequencies. When the results of the two time series analyses are considered together as a multiple time series analysis design, it can be concluded that there has been a significant decline in the trend of monthly burglary totals in the Target group, while no significant change has been demonstrated in the Control group.

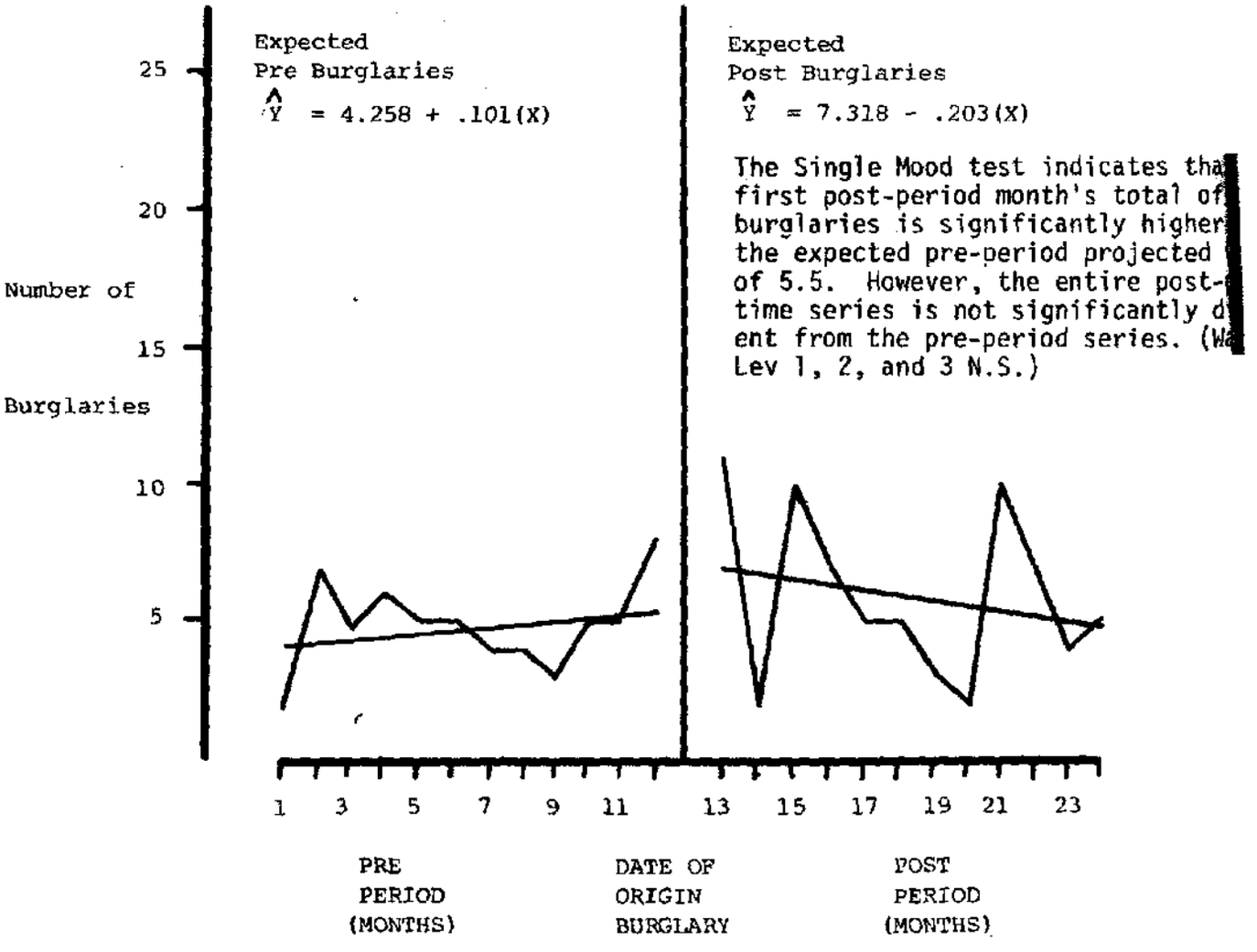
6 Walker Lev Test 1 resulted in an F ratio of 9.765 with 1 and 18 degrees of freedom, ($p < .01$). Walker Lev Tests 2 and 3 were statistically insignificant, indicating no significant change in the level of the time series.

Figure 5

Pre/Post Monthly Burglary Frequency
In Control Group
(N = 225)

Time Series Analysis Results:

Walker-Lev 1 -- F = 1.006, 1/ 20 d.f., N.S.
Walker-Lev 2 -- F = .106, 1, 20 d.f.. N.S.
Walker-Lev 3 -- F = .649, 1, 21 d.f., N.S.
Double Mood -- T = .81 , 20 d.f., N.S.
Single Mood -- T =-2.79 , 10 d.f.. P i



totals *are* distributed over time by month, a statistically significant downward pattern is found. This finding, coupled with the corresponding insignificant change in the Control group's post-period trend, strongly suggests that the effects of the survey are a function of time. Although comparison of the pre/post totals and averages can often give an accurate measure of the overall change in post-intervention burglaries, only by plotting the crime incidents out over time does the direction and level of the trend demonstrate itself.

There *are* at least three important questions left unanswered:

1) What was the level of compliance with the security suggestions?

2) Is there any association between compliance and subsequent victimization?

3) If there is an association, what is its direction, and is it statistically significant?

The following section will attempt to answer these questions.

2. COMPLIANCE WITH SECURITY SUGGESTIONS

a. Compliance in the Target Group

There were a total of 14 general categories of security suggestions. Table 6 lists each of these 14 suggestion types, the frequency with which each was made, and the percentage having partial or full compliance at the time of the six month follow-up survey.

The Target group had complied partially or fully with thirty-two percent (626 of 1,979 suggestions) of the suggestions made. The highest rate of compliance is for money handling and fence improvements. The lowest rate of compliance was for window glazing and skylight security improvement.

Compliance rates were calculated for each surveyed business by dividing the number of suggestions fully or partially complied with by the total number of suggestions made for each business and then multiplying the result by 100 percent. In other words, if a business had received four suggestions and fully or partially complied with three of them, their compliance rate would be 3 f 4 = (.75) (100%) = 75% compliance rate.

TABLE 6

Security Suggestions and Compliance Rate

	Number of Times Suggested	Number With Full or Partial Compliance	Percent Compliance
Property I.D.	362	96	26.5%
Locks	93	29	30.2%
Padlocks	42	15	35.7%
Alarms	250	63	25.2%
Lighting	159	66	41.5%
Door Improvements	271	99	36.5%
Money Handling	91	55	60.4%
Windows	158	44	27.8%
Window Glazing	11	1	9.1%
Address Visibility	123	25	20.3%
Key Control	97	37	38.1%
Safe Improvement	50	11	22.0%
Fence Improvement	18	9	50.0%
Iron Work	2	0	0.0%
Shoplift Precautions	6	2	33.3%
Skylight Security	6	1	16.7%
Miscellaneous Precautions	240	73	30.4%
Totals	1,973	626	31.7%
Average per Business	4.5	1.44	32.0%

Table 7 breaks these compliance rates down by team area. The compliance rates were grouped into six categories (0%, 1-25%, 26-50%, 51-75%, 76-99% and 100%) and cross tabulated with each of the county's team policing areas. Team area 1 had the highest rate of noncompliance (85.1%), while Team 5 had the lowest noncompliance rate (20.8%). Both Team 2 and Team 5 had the highest rate of full compliance (100%) to the survey recommendations (5.9%). When the highest three compliance categories (51-100%) are combined into a single group, Team 2 yielded the highest rate of compliance 33.3 percent, or 38 of 113 businesses.

The disappointing result of this analysis is that it reveals that only one quarter (23.9%) of the entire Target group had a compliance rate greater than 50 percent. In other words, one quarter of the businesses complied with at least half of their total security suggestions. Of the remaining businesses, 40 percent (N=174) had complied with 1-50 percent of the suggestions, and 36 percent had complied with none of the suggestions.

Table 7

Compliance by Team Area

Compliance Rate (%)	Team Policing Areas 1	2	3	4	5	Row Total N %
0% (No Compliance)	85.1%	36.4%	32.5%	35.1%	20.8%	157 36%
1-25%	1.4%	8.3%	18.0%	16.2%	21.6%	63 14.5%
26-50%	8.9%	22.0%	28.4%	25.9%	32.0%	111 25.5%
51-75%	1.9%	24.1%	13.9%	18.3%	16.9%	73 16.7%
76-99%	0.0%	3.3%	4.3%	3.3%	3.3%	15 3.4%
100%	2.7%	5.9%	2.8%	1.2%	5.9%	17 3.8%
51-100%	4.6%	33.3%	21.1%	22.8%	29.7%	
Column Total N	32	113	155	69	67	435
%	7.3%	25.9%	35.6%	15.8%	15.4%	100.0%

These findings are of major importance when considering the relatively small measured effect of the program on post-survey burglaries. The real intervention in this project is not just the survey itself, but the compliance to the recommendations. If there is relatively little compliance, there will probably be little positive effect. This issue, whether there is any relationship between compliance with the suggestions and subsequent post-survey burglary rates, is of critical significance, since this assumption lies at the heart of all premise survey programs.

B. Effect of Compliance on Burglary Risk

To test the strength of the relationship between compliance rates and burglary rates, a series of several cross tabulations were generated. The first is a cross tabulation between compliance rates and total presurvey burglaries. The second cross tabluation involves the association between compliance rates and post-survey victimization.7

There is no consistent (linear) relationship between recent prior victimization and compliance rates. Table 8 shows that about half of the two lowest compliance groups had one or more pre-survey burglaries. A slightly greater portion of those in the 26-50% compliance group had experienced at least one prior victimization. But for some unexplained reason only one third (33.1%) of those in the 76 to 99 percent compliance group had experienced a pre-survey burglary. The highest rates of prior victimization are in the 26 to 50 percent and 100 percent compliance groups. The expected relationship between these two factors is that compliance would increase as pre-survey burglaries increased, but the above data does not entirely support that notion.

Table 8

Pre-Survey Burglary Risk by Compliance Rate:

Full and Partial Compliance

Compliance Rates	Probability of No Pre-Survey Burglaries	Probability of 1 or More Pre-Survey Burglaries	Total Businesses
0%	53.4%	46.6%	157
1-25%	46.4%	53.6%	63
26-50%	40.0%	60.0%	111
51-75%	47.0%	53.0%	73
76-99%	66.9%	33.1%	15
100%	39.6%	60.4%	17
			436
TOTAL	47.8%	52.2%	(100%)
	(N = 208)	(N = 227)	

Chi Square = 7.387, 5 d.f., significance = .193, not statistically significant.

The data in Tables 8 and 9 contain all pre-survey burglaries, uncorrected for selection bias. This was done since the business proprietors are likely influenced by all victimizations regardless of any selection bias exercised in becoming part of the survey. However, before the data was tested to measure the effect of compliance on the average number of post-survey burglaries the pre-survey data was corrected for the selection bias as described in Appendix A.

Table 9 and Figure 7 provide the breakdown of compliance rates by the proportion of businesses burglarized one or more times during the post-survey period.

Table 9

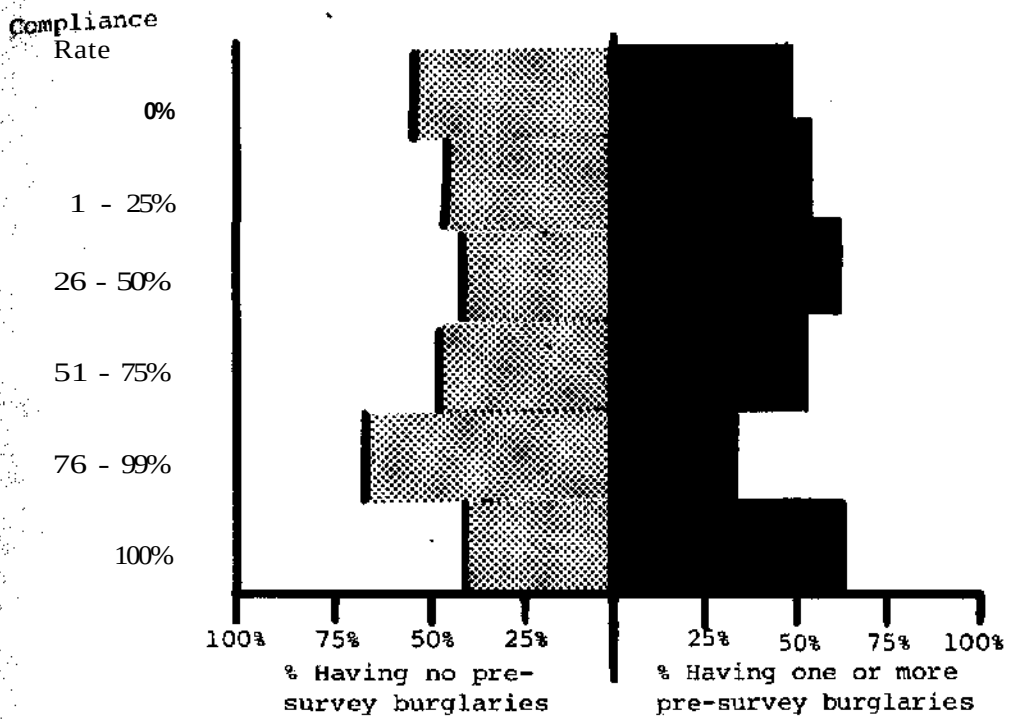
Post-Survey Burglary Risk by Compliance Rate:
Full and Partial Compliance

Compliance Rates	Probability of No Post-Survey Burglaries	Probability of 1 or More Post-Survey Burglaries	Total N / %
0%	85.2%	14.8%	157 36.0%
1-25%	76.5%	23.5%	63 14.5%
26-50%	81.4%	18.6%	111 25.5%
51-75%	69.7%	30.3%	73 16.7%
76-99%	96.3%	3.7%	15 3.4%
100%	81.0%	19.0%	17 3.8%
Total N	351	84	435
%	80.6%	19.4%	100.0%

[a] Chi Square = 10.71, 5 d.f., significance = .0574, nearly statistically significant. (Significance needed = .050.)

Figure 6

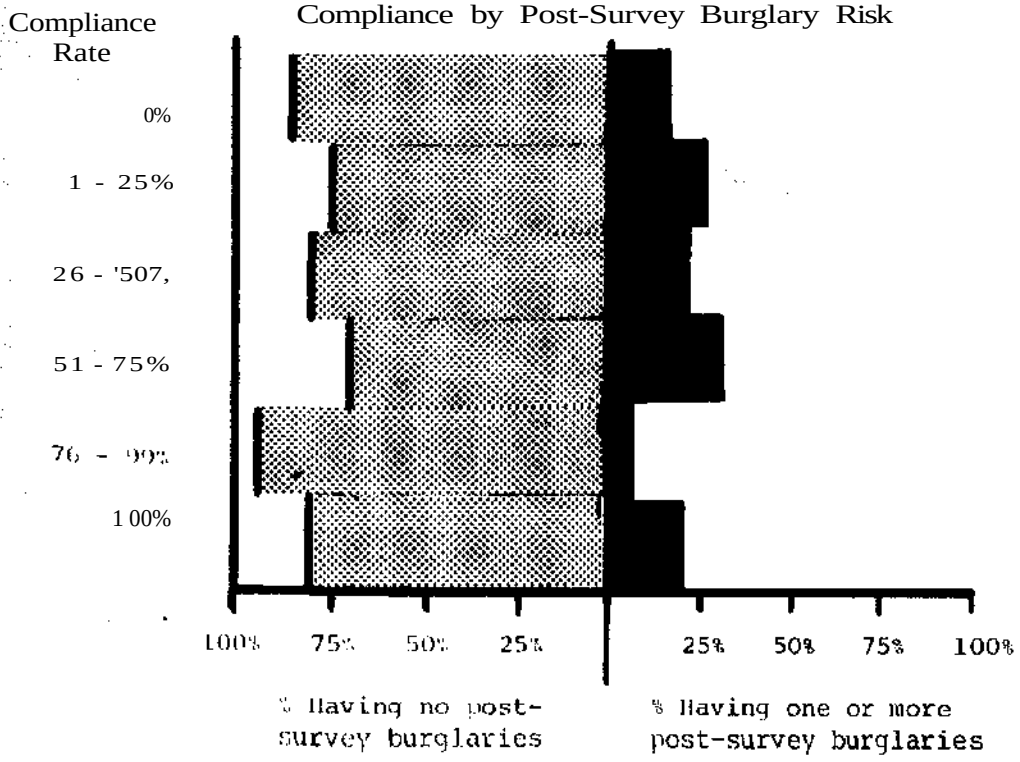
Compliance by Pre-Survey Burglary Risk[a]



[a]This figure includes all 327 pre-survey burglaries, uncorrected for selection bias. (See Appendix A for explanation of correction.)

Figure 7

Compliance by Post-Survey Burglary Risk



The expected relationship is that as compliance rates increase, burglaries will decrease. This is the key premise underlying all security survey programs. The data demonstrates another mixed (nonlinear) relationship between compliance and subsequent burglary risk. For those with no compliance there is approximately a 15 percent chance of post-survey victimization within a one-year period. The risk rises to a high of 30.3 percent for the 51-75 percent compliance group, and then (expectedly) drops to only 3.3 percent in the 76-99 percent compliance group and (unexpectedly) increases to 19 percent in the 100 percent compliance group.

When the data in Table 9 and Figure 7 are regrouped into 0-75 percent and 76-100 percent compliance groups a noticeable drop in risk of post-survey victimization is evident. The table below describes this breakdown:

Table 10

Post-Survey Burglary Risk by Combined Compliance Rate:
Full and Partial Compliance[3]

Compliance Rate[a]	% With No Post-Survey Burglaries	% With 1 or More Post-Survey Burglaries
Low & Medium 0-75% Compliance	79.9% (N = 322)	20.1% (N = 81)
High 76-100% Compliance	87.1% (N = 27)	12.9% (N = 4)

[a] X2 = 0.946, N.S., z test between proportions burglarized (20.1% vs. 12.9%) = 1.045, N.S. This table is based on a compliance rate derived from partial or full compliance to each suggestion made.

The risk of post-survey burglary drops from 20.1 percent (1 in 5) in the low and medium compliance group to 12.9 percent (1 in 8) in the high compliance businesses. Although this 7.6 percent absolute decrease (37.8% in relative terms) 10 is not statistically significant, it certainly can be viewed as a practically significant, positive effect. Unfortunately with this small a subsample (N = 31), the difference in post-survey risk for the high compliance group has a greater than 15 percent probability of being due to chance or random fluctuations alone.

1° Absolute difference = 20.1% - 12.9% = 7.6%. Relative difference = $\frac{20.1\% - 12.9\%}{20.1\%} = \frac{7.6\%}{20.1\%} = 37.8\%$

The previous analysis is considered both partial and complete compliance with each security suggestion in the computation of the compliance rate for each business. A more discerning alternative is to include only full compliance with individual suggestions in the analysis. When this is done the following relationship emerges:

Table 11

Post-Survey Burglary Risk by Combined Compliance Rate:
Full Compliance Only

Compliance Rate	% With No Post-Survey Burglaries	% With 1 or More Post-Survey Burglaries
0-75%	80.1% (N=326)	19.9% (N=81)
76-100%	88.9% (N = 24)	11.1% (N = 3)

The risk of burglary during the 12 month post-survey period for the low-medium compliance group was 19.9% {1 in 5), while the risk for those in the high compliance group was only 11.1 percent (about 1 in 10). This represents an

[a] X2 = 1.537, N.S., z test between proportions burglarized (19.9% vs 11.1) = 1.537, p-- .06. This table is based on a compliance rate where only those with full compliance with individual security suggestions were considered in the analysis. In other words, if a business received three suggestions and partially complied with one of them and fully complied with another, only the fully complied with suggestion would be computed in the overall compliance rate for that business, e.g.: 1 f 3 = 33% compliance rate.

absolute decrease of 8.8 percent and a relative decrease of 44.2 percent.[11] This difference is very close to being statistically significant (p = .06) The foregoing analysis found nearly significant differences in the risk of being burglarized one or more times between the low compliance group (O-759S compliance) and the high compliance group (76-100%). To provide a more sensitive measure of the effect of high compliance and post-survey burglary, the average (mean) number of burglaries within the high compliance subgroup were compared with the average number of burglaries in the Control group according to the following design:

	Comparison			Effect
Test 1	High compliance pre-survey burglary average	vs.	Control group pre-survey burglary average	Sample equivalence
Test 2	High compliance pre-survey burglary average	vs.	High compliance post-survey burglary average	Pre/post high compliance change
Test 3	Control group pre-period burglary average	vs.	Control group post-period burglary average	Pre/post Control change.
Test 4	High compliance post-period burglary average	vs.	Control group post-period burglary average.	Effect of compliance

Again, as in the previous comparisons, both the high compliance Target group (N = 27) and the total Control group (N =225) were corrected for the selection bias be removing that burglary that got each business into the program from the pre-period total (See Appendix A for explanation of correction procedure).

---

11 Absolute difference = 19.9% - 11.1% = 8.8%

$$\text{Relative Difference} = \frac{19.9\% - 11.1\%}{19.9\%} = \frac{8.8\%}{19.9\%} = 44.2\%$$

The data for each of the above comparisons is presented in Table 12 below.

Table 12

High Compliance Target vs. Control Group Comparisons[3]

Test 1	High Comp. Target Group Pre-Survey (N = 27) Average Burglaries = .248 S.D. = .577	vs.	Control Group Pre-Survey (N = 225) Average Burglaries = .271 S.D. = .703	t = -.163 No statistically significant difference; therefore, samples are equivalent p = .43
Test 2	High Comp. Target Group Pre-Survey (N =27) Average Burglaries = .248 S.O. = .577	vs.	High Comp. Target Group Post-Survey (N - 27) Average Burglaries = .166 S.D. = .500	t = .549 Statistically insignificant decrease in Target post-survey burglaries p = .25
Test 3	Control Group Pre-Period (N = 225) Average Burglaries = .271 S.D. = .703	vs.	Control Group Post Period (N = 225) Average Burglaries = .328 S.D. = .696	*I* = -1.06 Statistically insignificant increase in Control post-survey burglaries p = .15
Test 4	High Comp. Target Group Post-Survey (N * 27) Average Burglaries = .166 S.D. = .500	vs.	Control Group Post-Period (N = 225) Average Burglaries = .328 S.D. = .696	t = -1.492 significant at p = .068

[a] S.D. = Standard Deviation. The statistics in this table were computed after correcting for the selection bias in the Target and Control groups. See Appendix A for explanation of the correction procedure.

The result of Test 1 indicates that the high compliance Target group and Control group have equivalent pre-period burglary rates; therefore, an experimental design can be employed where the measure of the survey's effect will be the comparison of the post-period average of the high compliance group and the Control group (test 4).

Test 2 yielded a statistically insignificant decrease in the high compliance group's post-survey burglary rate. The high compliance group's average burglary rate decreased 33 percent from .248 burglaries per business during the pre-survey period to .166 burglaries per business during the post-survey period. Although this might be considered to be practically significant, the small sample size and the high variance in the number of burglaries diminish the statistical significance of the pre/post high compliance difference.

Test 3 did not yield a statistically significant increase in the Control group's post-survey average burglary rate. Although there was a 21 percent increase in the average number of burglaries per business, the high variability in the Control group's data reduced the statistical significance of the increased burglary rate ($p = .15$).

The most critical measure of program effect is the comparison of the post-period rates of the high compliance Target and Control groups. Test 4 reveals that although the Control group's post-period average is nearly twice as large as the Target group's burglary average, this difference has a 6.8 percent probability of occurring by chance alone. This exceeds the generally accepted 5 percent level for the difference to be considered "statistically" significant. If the reader cannot ignore or tolerate this 1.8 percent difference in significance, then there has at least been a practically significant decrease in burglaries for those 27 businesses that complied at a level of 76 percent or greater.

These test results indicate that although the high compliance Target group and Control group's post-period burglary rates were in the expected direction (Target: decreased, Control: increased) the sample size and high variance in the number of burglaries within each group operated to decrease the statistical significance of the results. The result of the most important

comparison (Test 4) is an excellent example of how statistical tests can yield deceptively conservative results. The high compliance group's post-survey mean rate of burglary is 97.6 percent lower than the Control group's post-period mean rate, yet the variability in the number of burglaries in each group reduced the level of significance to just beyond statistical significance ($p = .068$).

The t statistic was used for this analysis. This test determines whether the difference in average number of burglaries between the groups is greater than can be attributed to chance variation. For tests 1, 3 and 4 a t value equal to or greater than + or - 1.645 is necessary for statistical significance, (d.f. = 120, 1 - tailed)

For Test 2 a t value equal to or greater than +" or - 1.706 is needed for significance. If these t values are exceeded, there is less than a 5 percent probability that the difference in average burglary rates is due to chance alone, (d.f. = 26, 1-tailed)

The next step in the analysis of this high compliance subgroup was to list the types of security suggestions made and cross tabulate this list with the degree of compliance to each type of suggestion. Table 13 lists the thirteen types of suggestions made, the number of suggestions made, and the percentage of compliance for each type. This listing will point out the specific types of security improvements that have proved of benefit to the high compliance group.

When Table 13 is compared with Table 6, it can be seen that the rates of compliance in the high compliance group are much higher for all security-categories. The average rate of compliance for the total of 435 Targeted businesses was only 31.6 percent, while the compliance rate for the high compliance group was 90.8 percent. The total Target group's range of compliance varies from a low of 9.1 percent (window glazing) to a high of 60.4 percent (money handling). The range of compliance rates for the high compliance group varies from a low of 60 percent (window impovements excluding glazing) to 100% compliance in five categories (lighting improvements, moneyhandling, key control, safe improvement, fence improvement).

It would be beneficial to the future effectiveness of the commercial premise security program if the files for all of these 27 businesses were looked at in detail for the specific types of suggestions made. On-site reinspections of each business could then be conducted to see first-hand the exact type and amount of compliance. This information could then be used to guide other businessmen in making better use of the benefits of this program.

Table 13

Security Suggestions and Compliance Rates for
High Compliance Group
(N=27)

Security Suggestion Type	Number of Suggestions Made	Percent With Full Compliance
Property I.D.	23	91.3% (21 of 23)
Locks	3	66.6% (2 of 3)
Padlocks	2	100.0% (2 of 2)
Alarms	14	85.7% (12 of 14)
Lighting Improvement	12	100.0% (12 of 12)
Door Improvement	14	92.9% (13 of 14)
Money Handling	6	100.0% (6 of 6)
Windows	5	60.0% { 3 of 5)
Address Visibility	6	83.3% (5 of 6)
Key Control	8	100.0% (8 of 8)
Safe Improvement	2	100.0% (2 of 2)
Fence Improvement	1	100.0% (1 of 1)
Miscellaneous Suggestions	13	92.3% (12 of 13)
Totals	109	90.8% (99 of 109)
Average per business	4.03	90.8% (3.6 of 4)

3. MULTNOMAH AND CLACKAMAS COUNTY TIME SERIES ANALYSIS OF COMMERCIAL BURGLARY

Sections 1 and 2 of this evaluation deal with determining the direction and significance of change in the incidence of burglaries within the Target and Control groups and the effect of compliance rates on the risk of post-survey burglary. This third section will describe the design and results of a multiple time series of the incidence of county-wide commercial burglary (1:417-419). This examination will compare the county-wide monthly commercial burglary totals for Multnomah and Clackamas County over an 18 month pre-program period and a three-stage post period of 12, 18, and 27 months. Although the primary measures of program impact are the pre/post Target-Control group comparisons, this jurisdiction-wide time series will monitor the direction and magnitude of change in burglary over all of Multnomah County in comparison with an adjacent nonequivalent county. Such a design will provide an answer to the following questions:

1) Since the start of the premise survey program has there been a significant change in the monthly incidence of county-wide commercial burglaries?

2) Secondarily, has there been a significant change over the same time period in the monthly incidence of commercial burglary in an adjacent county; one not having a formal commercial premise inspection program?

The previous analyses have shown that there was a significant downward change in the slope of the Target group's monthly burglaries over a one-year period, and that there has been a nearly statistically significant reduction in the high compliance group's risk of burglary. The current comparison will indicate whether there has been a significant decrease in the county-wide incidence of commercial burglary.

If this analysis yields a significant decrease in the monthly burglary totals for Multnomah County, this does not necessarily mean that the decrease is due Solely to the program, particularly since there was a substantial increase 1+22%) in the Control group's burglaries during the first twelve post-period

months. However, such a decrease could be a mixture of program impact plus a reflection of change in all of the other factors that influence commercial burglary in Multnomah County. Some control for this lack of precision is introduced by comparing the distribution of burglary during the same time period for a nonparticipating county. If a similar decrease is noticed in the burglaries during the same time period in Clackamas County, this would indicate that some of Multnomah County's declining rate might be due to factors other than the program itself.

Essentially, the comparison with Cfackamas County will indicate the trend in county-wide crime which would have been expected in the absence of the program, assuming that both Multnomah and Clackamas County are equivalently exposed to the same types of change in crime influencing factors, other than Mulnomah County's crime prevention program.

Figure 8 is a graph of the distribution of total nonresidential burglaries for the period January, 1976 through June 1978. The dashed vertical line at the end of June 1977 marks the beginning of the commercial premise survey program.*[2] The straight lines running through the array of burglary totals are the least square trend lines for the pre and post periods for each of the two counties.[13]

The trend for the pre-period is decreasing for both counties, however, Clackamas county's rate of decrease is greater.14

12 Since each of the businesses in the previous Target-Control time series were given the premise survey at different days throughout the one-year project period (July 1, 1977, to June 30, 1978), all businesses had to be registered to a common date of intervention, and common-twelve month pre and twelve-month post periods had to be constructed around that common date. For instance, if a business was surveyed on August 12, 1977 that date was used as the date of intervention and 12-month pre and post time frames were constructed around that date. If another business was surveyed on May 3, 1978, that date was likewise used as the date of intervetion and pre/post time periods were constructed around that date. Therefore, when this process was completed, all of the dates of intervention were registered to a common

(Footnote 12 continued, text continues on next page)

point. The twelve pre and post months surrounding their common date of intervention are not actual months (January, February, March, etc.). but relative months, each 30.4 days long (30.4 x 12 = 364.8 or 365 days). The actual process of convertion and registration involved a computer program which transformed the six digit date of each burglary (e.g. 011578) into its Julian calendar date. These dates were then subtracted from the Julian date of the premise survey, and the result was divided by 30.4. The result was the number of relative months each burglary occurred in reference to a common date of intervention. However, since this county-wide time series is based on the entire non-residential population of the two counties involved, the plot of crime over the 45-month period uses actual months, rather than artificially constructed relative months. (See Figures 8-10)

[10] Multnomah County obviously has more commercial burglaries than Clackamas County. Although this difference is extreme, what is of primary concern in this comparison is not the difference in the actual numbers of burglaries, but the relative pattern of burglaries over time. If one county's trend is increasing significantly while the other's is decreasing significantly over the post period, that relative change is of importance, not the comparison of the absolute number of burglaries.

*[4] Clackamas County pre-period least square equation: $\hat{Y} = 59.725 - .901$. Multnomah County: $\hat{Y} = 83.529 - .424$. This illustrates that for each month in the pre-period, Clackamas County's total decreased .901 burglaries while Multnomah County decreased at a litte less than one half that rate, .424 burglaries less per month.

Three separate time series were done for each county (6 in total). The reason for doing separate 12, 18 and 27 month time series analyses was to determine if there were any short term (12 month) changes in the burglary trend, and to see if this initial trend increased, decreased or equalized ("flattened out") over the entire 27 month post-period. The intermediate 18 month time series was done simply to compare equal pre/post time periods.

The comparison of 18 month pre and 12 month post series yielded a statistically significant decrease in Multnomah County's post-survey trend (Walker-Lev 1: $F = 5.61$, with 1 and 26 d.f., $p < .01$).[15] No significant change occurred in the level (intercept) of the post-program burglary pattern. (See Figure 8)

The 18 month pre and 12 month post period time series tests indicated that there was no significant change in the slope (up or down direction) or in the intercept (level) for Clackamas County. There was, however, a significant downward slope to the entire 30 month Clackamas County series, suggesting a strong <u>overall</u> decreasing trend in Clackamas County's burglary trend (Walker-Lev 2: $F = 6.45$, with 1 and 26 d.f., $p < .025$, See Figure 8).

This short term (12 month post) examination illustrates a significant downward direction to both county's commercial burglary trends, but Multnomah's trend was not manifested until after the program was started. The significant decrease was largely a result of the drop in burglaries between January and March of 1978.

[15] Less than 1 percent probability that the change was due to chance fluctuation alone.

These findings are only suggestive. More conclusive findings can only be made after examining the entire 27-month post-survey series.

The 18-month pre, 18-month post analysis produced no statistically significant change in the post series for either county. Both counties continued to experience generally declining burglary rates. This shows that the significant 12-month decrease in Multnomah County's trend was short lived, largely because of the relatively high reporting of burglaries in July and November of 1978 (See Figure 9).

The full 27 month post time series continued to show a general leveling of the post-program trend in Multnomah County. For Multnomah County there was a continued decrease in the slope of the monthly burglary totals, but at a more moderate rate (18 month pre slope: - .424, 27-month post slope: -.142). Additionally, the level (intercept) of the pre and post series are nearly identical (pre: 83.5, post: 80.1). This leads to the conclusion that overall commercial burglaries reported to the police have been fairly consistent for the past three years and nine months in Multnomah County. (See Figure 10)

In Clackamas County a different post-program pattern emerged from the 27 month analysis. There has been a nearly statistically significant increase in the post-program incidence of burglary (Walker-Lev 1: $F = 5.71$, with 1 and 41 d.f., $p < .025$). While the number of commercial burglaries was decreasing at an average rate of .9 burglaries per month during the pre-period, the trend reversed itself, so that during the post period there was a monthly increase of .35 burglaries. This finding is not conclusive however.[16]

[16] Because of a statistically significant first-order (lag 1) auto correlation of the residuals (Durbin-Watson = 1.36, significant at $p < .05$) the F ratio was inflated. After transforming the monthly burglary totals using a generalized least squares technique described by Ostrom (7:35-38), the transformed data was resubmitted to the Walker-Lev program. The resulting F ratio, although high, was not quite statistically significant at the .05 level. ($F = 3.39$, with 1 and 41 d.f., $p < .10$). The transformed data also yielded statistically insignificant F ratios for Walker-Lev tests 2 and 3.

Once Clackamas County's data was corrected for a significant autocorrelation problem, the downward post-survey slope was no longer statistically significant from the pre-survey slope. However, even after correcting the monthly totals a practically significant change remained in the pre-post slopes (transformed pre slope: -.79, transformed post slope: + .24, Walker-Lev 1: $F = 3.39$ with 1, 41 d.f., sig. at $p > .05 < .10$).

In summary this county-wide time series analysis shows that first, there was a significant drop in the trend of Multnomah County's 12-month post-period burglary totals. Secondly, this reduction leveled out over time, so that by the end of the 27th post-survey month, no statistically significant change remained in comparison with the 18-month period prior to the beginning of the program. Finally, Clackamas County exhibited an overall pre-post, short-term decline that eventually was reversed, ending with a nearly significant increase over the 27 month post period.

Because of unknown differences in these two county's reporting rates, inequities in commercial growth rates, and changes in all of the other factors that influence their respective rates of commercial burglary, no firm conclusions can be reached regarding this jurisdiction-wide examination. The fact remains, however, that regardless of any possible differences in the opportunity for commercial burglary, Multnomah County has maintained a relatively stable burglary frequency, while Clackamas County has demonstrated a nearly statistically significant increase.[17]

See Appendix C.

found that "...it appears that security surveys are the single most critical element in the success of the program to date." (10:9) THOR workers conducted security surveys in nearly 100 percent of the businesses in Atlanta. The post-survey data indicated that there was a 25.4 percent reduction in the annual rate of commercial burglary. Researchers found that 75 percent of the commercial establishments surveyed complied with at least one of the security recommendations (10:13). The Multnomah County sample showed that 64 percent of the businesses complied partially or fully with at least one of their security suggestions. However, using this definition of compliance (at least one complied with suggestion per business) gives a deceptively high index of compliance. A more meaningful measure of compliance, and one used in this report, is a rate of compliance based on the percentage of the total number of suggestions made. When this index is used only 31.7 percent of the total number of suggestions were complied with in Multnomah County (621 of 1,973).

In Multnomah County the presumed importance of high compliance in reducing burglary vulnerability was demonstrated by the fact that there were 97.6 percent fewer burglaries per business in those businesses having a compliance rate of at least 76 percent as compared with the nonparticipating control group. Unfortunately the significance of this finding was diluted due to the small size of the high compliance group (N=27) and the high variability in the number of burglaries per business within both the High Compliance and Control groups.

The qualified success of the MCCP security survey program is largely due to this relatively low rate of overall compliance. Although it is questionable to draw externally valid conclusions from such a small subgroup, the findings of the pre/post burglary frequency of the high compliance group provides strongly suggestive evidence that increased emphasis should be placed on raising the overall rate of compliance.

3. Change Compliance Follow-up Schedule.

During the first year of program implementation a single six-month post-survey telephone follow-up was made in each surveyed business. It is believed by project and evaluative staff that more frequent compliance checks would help emphasize MCCPU's firm commitment to the survey program and the importance of compliance. Beginning in early 1980 project staff began making phone follow-up checks approximately one month after the survey. These are followed with complete on-site compliance checks, six months from the survey date. It is hoped that the one month phone check will serve as a prompter to encourage security improvements. The on-site follow-up will provide another opportunity for officer/citizen contact and another occasion to determine the degree of compliance and, perhaps, to offer further suggestions for added security.

4. Continue to document the new surveys being conducted so that an evaluation of the new sample of businesses might be conducted in the future.

The MCCPU is in a unique position to supply continued evaluation of the effectiveness of security inspections. The value of the program and the present evaluation can be enhanced if the burglary experience of the current sample of the 660 Target and Control businesses is monitored 18 to 48 months after the initial survey to determine the intermediate to long range effect of the program. Those businesses surveyed since July 1, 1978 should also have the'ir burglaries and compliance rates recorded to provide a replicative sample for comparison with the results of the current survey.

BIBLIOGRAPHY

1. Campbell, Donald T. "Reforms and Experiments." American Psychologist, 24:409-29, April, 1979.

2. _____and Laurence Ross. "The Connecticiut Crackdown on Speeding: Time Series Data in Quasi-Experimental Analysis." Law and Society Review, 3: 33-53, January, 1968.

3. International Training, Research and Evaluation Council. National Evaluation Program Phase 1 Summary Report: Crime Prevention Security Surveys. Washington D.C.: Law Enforcement Assistance Administration, 1977.

4. Kaplan, Howard, et al. Crime Prevention Through Environmental Design: Final Report on Commercial Demonstration Portland, Oregon. Arlington, Virginia: Westinghouse Electric Corporation, 1978.

5. Kirk, Roger E. Experimental Design: Procedures for the Behavioral Sciences. Belmont, California: Brooks/Cole Publishing Company, 1968.

6. Mulberg, Anthony C. and Shelly Wein Bellevue Citizen Involvement in Burglary Prevention Evaluation Report. Seattle: King County Law and Justice Planning Office, 1976.

7. Ostrom, Charles W., Jr. Time Series Analysis: Regression Techniques. Beverly Hills, California: Sage Publications

8. Rifai, Marlene A Young. Premise Survey Research Design. Beaverton, Oregon: Applied Systems Research and Development, 1977

9. Schneider, Anne L. et al. Handbook of Resources for Criminal Justice Evaluators. Eugene, Oregon: Institute of Policy Analysis, 1978.

APPENDIX A

SAMPLE EQUIVALENCE

Sample Equivalence

Ideally, the high risk Target group businesses (T_1) were to have been chosen at random from all burglary victims during the period July 1, 1977, through June 30, 1978. However, in talking with project staff it was found that some non-random judgments were made in selecting businesses to be surveyed. Although the Target and Control groups are nearly identical in terms of geographic location (team area) and business type, it was found that the Target group had a significantly higher rate of burglary when uncorrected for selection bias (See Table A-1). The second Target group (T_2) was selected at random from Multnomah County's Personal Assessment Tax Roll. This group was selected without regard to its pre-program burglary rate. The Control group (C) was selected from the remaining pool of burglary victims occurring during this same time period. This appendix will describe in some detail the selection bias used in the selection of T_1 and C which introduced the potential for substantial statistical regression and the method used to correct for this problem.

Table A-1 lists the results of a pre-survey comparison of the Target and Control groups. Comparison of the average rate of burglary for the T_1 and C groups showed that there is, in fact, a significantly higher average number of burglaries in T_1 group ($\bar{X} = 1.437$) compared to the C group ($\bar{X} = 1.271$). Likewise, when that crime which got both the T_1 and C groups into the sample is removed (-1) the difference is still significant ($T_{1(-1)}: \bar{X} = .437$ versus $C_{(-1)} : \bar{X} = .271$) ($Z = 2.03$, $p < .05$).

Therefore, in order to achieve a comparable Target and Control group it was necessary to combine the two Target groups (T_1 and T_2) into a single group and remove from the analysis the burglary that got each T_1 business into the project. When this was done, the combined Target group ($T_{1(-1)} + T_2$) was statistically identical to the Control group ($C_{(-1)}$) in terms of burglary rates. The Control group also had each of its selection crimes removed from the analysis.

TABLE A-I

Comparison of Target and Control Group
Pre-Survey Burglary Averages

Group			Difference Between Pre-Survey Means
T_1 (Pre) (N = 198) $\bar{X}$ = 1.437	vs.	C (Pre) (N = 225) $\bar{X}$ = 1.271	z = 2.02, sig at p<.05
$T_{1(-1)<Pre>}$ (N = 198) $\bar{X}$ = .437	vs.	$C_{(-1)}$ (Pre) (N = 225) $\bar{X}$ = .271	z = 2.03, sig at p < .05
$T_{1(-1)}+T_2$ (Pre) (N = 435) $\bar{X}$ =.294	vs.	$C_{(-1)}$ (pre) (N = 225) $\bar{X}$ =,271	z = .389, Not statistically significant, therefore Equivalent

[a] $\bar{X}$ = mean, or average number of burglaries per business.

[b] If there is a "statistically significant" difference between average ($\bar{X}$) burglary rates, this means that the difference between these averages is greater than that expected by chance alone. If the probability of the differences being due to chance alone is five percent or less ($p < .05$ or $p < .01$), the result is statistically significant.

FIGUUO A-l

Tarnet Croup Pre/Post Bur£lary Frequency
By Mórtth
(N = 435 business)

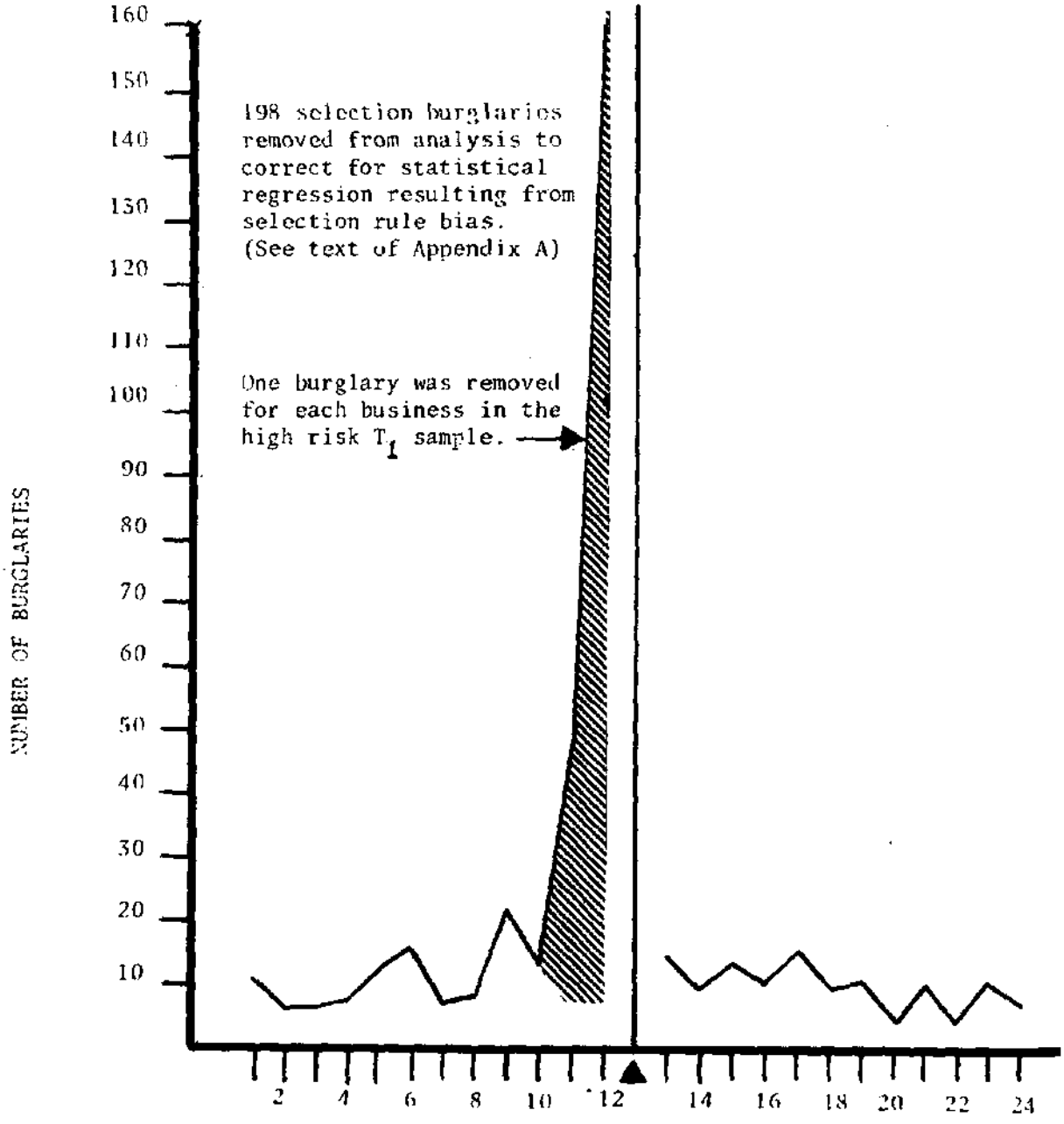


FIGURE A-2

Control Group Pre/Post Burglary Frequency by Month (N = 225)

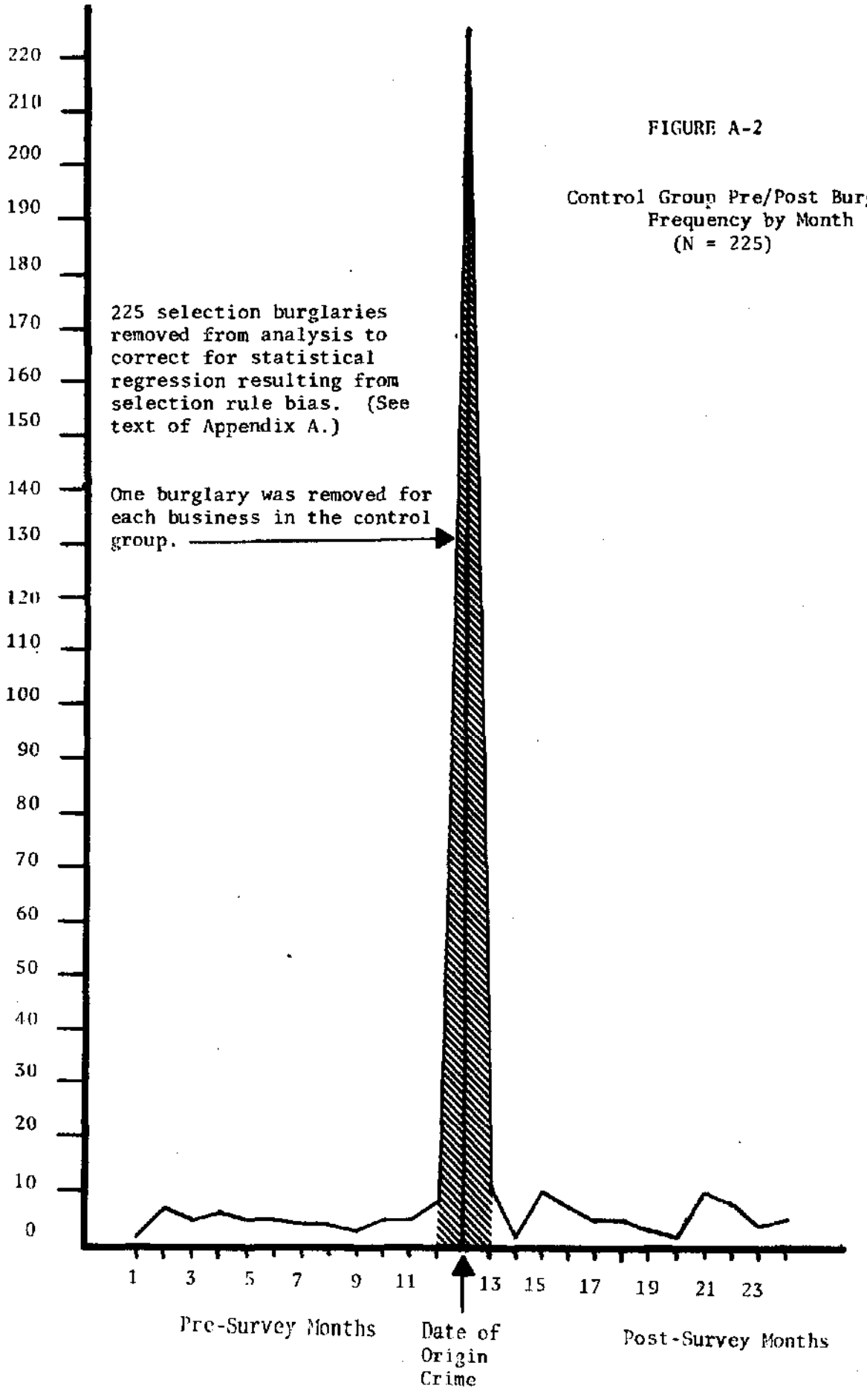


Figure A-2 demonstrates that the Control group experienced a similar drop in burglary after the "original crime."[2]

To correct for the natural regression which would result with or without any intervention, it was decided to delete that crime that got the T_1 group member into the sample and to delete the original crime for all members of the Control group. Resultingly, an equal correction was applied to every member of T_1 and C. Since T_2 was selected at random from the total population of businesses without regard for their victimization rates, no correction factor was applied to this group.

To summarize: The Target group consists of a combined high risk (T_1) and low risk (T_2) group of 435 businesses, where that crime that got each business in the program was removed from the high risk (T_1) group. The resulting symbol for this group is $T_{1(-1)} + T_2$. The Control group is composed of 225 high risk businesses, where that crime that got them in the program was likewise deleted from the analysis ($C_{(-1)}$). As can be seen in the bottom entry of Table A-1 there is no significant difference in the average number of burglaries per business between the combined and corrected Target groups and the corrected Control groups. ($T_{1(-1)} + T_2$ vs. $C_{(-1)}$).

---

[2] The point of intervention for the Target group was the date of the survey. Since the Control group did not receive a survey, the date of the "original crime" used to select each business as a Control group member was used as the point of intervention for the Control group.

APPENDIX B

ANALYSIS OF VARIANCE TABLES

A repeated measures analysis of variance was completed on three groups of businesses, including:

1. The corrected total Target and Control pre and post burglaries. ($T_{1(-1)} + T_2$ vs. $C_{(-1)}$)

2. A subset of 118 "high risk" businesses' pre and post burglary totals.

3. A subset of 543 "low risk" businesses' pre and post burglary totals.

Due to the fact that many of the Target and Control group members had no pre-survey burglaries, once the correction was made for the selection bias (See Appendix A), the pre and post burglary totals were transformed by adding one (1) to each of the businesses' pre and post totals and taking the natural $\log_{10}$ of the resulting number.

$$X' = \log_{10} (X + 1)$$

where X = Each businesses' pre or post total.

$\log_{10}$ = natural logarithm of X + 1

For instance, if the raw pre and post burglary totals for a particular business were:[1]

	Pre Total	Post Total
score (X)	2	1

Our transformed totals would be:

Pre Total	Post Total
$X' = 2 + 1 = 3 \log^{10} = .477$	$X' = 1 + 1 = 2 \log^{10} = .301$

[1] The log transformation of the values (burglaries) was accomplished additionally, normalize the distribution.

In the case of the low risk group analysis of variance, a value of two (2) was added to each pre and post score. The log of the resulting number was then used as the transformed score. In this case the transformation was:

$$x' = \log_{10} (X + 2)$$

TABLE B-I

Repeated Measures Analysis of Variance Summary Table for Total Sample

(Transformed Scores)
(N = 660)

Source of Variance	SS	df	MS	F
R, Between Subjects				
KA (Groups)	0.00004	1	0.0O004	<1,*
•businesses within •{Groups	55.7102	659	0.08454	
Within Subjects				
KB (Time Periods)	0.04242	1	0.04242	2.092**
KB	-0.01212	1	0.01212	<1*
mk x Subjects Blithin Groups	-13.97786	657	0.02128	

Not statistically significant.
p>.10 <.25

This analysis of variance indicates that there was no significant difference between the Target and Control groups' burglary incidence (F ratio less than 1).

The within subjects value represents a measurable, but statistically significant change in the total businesses' (Target and Control combined) pre/post burglaries. (F = 2.092, d.f. = 1, 657, significance = .10 <.25)

Since the overall test of significance did not lead to rejection of the null hypothesis that there was no change in pre and post burglary rates, no individual tests were performed on the within groups pre/post means and the between group, within time period means.

A second repeated measure analysis of variance was performed on the high risk businesses using both the Target and Control groups. These high risk businesses had one or more burglaries during the pre-survey period after correcting their burglary totals for the selection bias (see Appendix A). Consequently, many of these high risk businesses actually had two (2) or more burglaries prior to removing the burglary that got them into the program. The analysis summary is presented in Table B-2.

TABLE B-2

Repeated Measures Analysis of Variance For the High Risk Group

(Transformed Scores)
(N=128)[a]

Source Variance	SS	df	MS	F
Between Subjects		117		
A (Groups)	.098	1	.098	1*
Business Within Groups	22.36360	116	.1928	
Within Subjects				
P (Time Periods)	2.7664	1	2.7664	51.65**
P (Group x Time)	-.01624	1	- 0.01624	1 *
I x Subjects Within Groups	6.10589	114	0.05356	

Not statistically significant.
Significant at p .001

The overall F ratio resulting from the high risk group analysis of variance revealed no statistically significant differences between groups. However, there was a highly significant overall decrease in the businesses' burglary totals between time periods ($F = 51.65$, $p < .001$). The interaction of change between groups and time was insignificant.

Individual burglary totals were transformed from X (original score) to X', where $X' = \log_{10} (X + 1)$.

Three individual apriori tests were performed to determine the significance of the pre/post change in the Target and the Control groups. The results of these tests are presented below:

Comparison	Group Means	t Value	Significance
Pre/Post Target (N = 73)	Pre = .4072 Post = .1662	6.29	p <.00l
Pre/Post Control (N = 45)	Pre = .3467 Post = .1432	4.17	p < .001
Post-Target (N = 73) vs. Post-Control (N = 45)	Post Target = .1662 Post Control = .1432	.52	p <.25, not statistically significant.

The results above provide evidence that there has been a highly significant decrease in the post period burglaries for both the high risk Target and high risk Control groups. However, the drop in the Target group's post burglaries was greater than that of the Control group's decrease. It is surprising that such a large decline in burglaries would occur after removing the selection burglary from each business.

The insignificant result of the third test (post-Target vs. post-Control) indicates that there is no significant difference between the two groups' post-period burglary rates. The passage of time seems to be more of an influence on subsequent burglary rates than Target or Control group membership,

TABLE B-3

Repeated Measures Analysis of Variance
for the Low Risk Group

(Transformed Scores)
(N = 543)[a]

Source Variance	SS	df	MS	F
Between Subjects		543		
A (Groups)	,00366	1	,00366	1*
Businesses Within Sroups	105,49186	542	,23867	
Within Subjects				
:B (Time Periods)	.33062	1	.33062	14.89 **
JAB (Groups x Time)	.00366	1	.00366	1 *
JJ x Subjects Within proups	9.67963	540	.02220	

* Not statistically significant
** Significant at $p < .01$

Individual burglary totals were transformed from X (original score) to where $X' \log_{10} (X + 2)$

As in the previous two analyses, there is no statistically significant difference between groups for the low risk Target and Control sub-sample. (See Table B-3). Also, the interaction of time (pre/post) and group membership (Target-Control) did not reach statistical significance. There is, however, a statistically significant increase within businesses between time periods for both the Target and Control businesses.

Two individual apriori tests were computed to determine the significance of within group change between time periods. A third test was done to measure the difference between the Target and Control groups' post-period burglary frequency. The results of these tests are presented below.

Comparison	Group Mean	t Value	Significance
Pre/Post Target (N = 358)	Pre = .3010 Post = .3342	- 2.98	P < .01
Pre/Post Control (N = 185)	Pre = .3010 Post = .3415	- 2.61	p < .01
Post/Target (N = 358) vs. Post/Control (N = 185)	Post T = .3342 Post C = .3415	- .54	*

* Not statistically significant.

On page 16 of the text the tendency for the high risk groups to regress downward and the low risk group to regress upward to each group's respective mean burglary rates was described and depicted in Figure 2. The above test results confirm this contervaiing movement in both groups. That is, both the low risk Target and Control groups showed significant increases in their rates, and both the Target and Control high risk groups showed significant decreases in their respective post-period average burglaries.

APPENDIX C

TIME SERIES ANALYSIS TABLES
APPENDIX C

APPENDIX C

TIMES SERIES ANALYSIS TABLES AND RESULTS

The Target and Control group and the county-wide monthly burglary data were run on an interactive regression discontinuity program at the University of Washington.[1] This program calculates single and double Mood Tests in addition to Walker-Lev tests 1, 2 and 3. Serial correlations for time lags 1 through 4 are also generated.

The first runs were made using the Target group's monthly burglary totals for 10 pre months and 12 post months. The second analysis used the Control group's totals for 12 pre and 12 post months. Tables C-l and C-2 present the input and results of these runs.

---

[1] The program ("TIMES") was written by a programmer from the Institute of Policy Analysis, Eugene, Oregon. Those not familiar with regression discontinuity analysis can find explanations and applications of the various tests in Schneider (9: 2-39-2-66 and 4-57-74). Also see Campbell (1 and 2).

TABLE C-1

Target Group Pre/Post Regression
Discontinuity Analysis
(12 months Pre, 12 months Post)

Input: (Monthly Burglaries)
Pre Period - 11, 7, 7, 8, 13, 16, 8, 9, 22, 14
Post Period - 21, 10, 14, 11, 16, 10, 11, 5, 11, 5, 11, 8

Output:[a]

Walker-Lev 1

F ratio: 9.765 with, 1, 18 d.f., significant at $p < .01$

Walker-Lev 2

F ratio: .336 with 1, 18 d.f., not statistically significant

Walker-Lev 3

F ratio: .168 with 1, 19, d.f., not statistically significant

Mood Test

t = -.90, not significant

Double Mood Test

t = 0.00, not significant

Pre Data Regression Equation: $\hat{Y} = 6.67 + .879\ (X)$
Post Data Regression Equation: $\hat{Y} = 16.29 - .801\ (X)$

Interpretation: There has been a significant decrease in the slope of the post-period burglary data (Walker Lev 1: F = 9.765, 1, 18 d.f.$p < .01$).

[a] The actual output generates much more detail than is presented here.

TABLE C-2

Control Group Pre/Post
Regression Discontinuity Analysis

(12 months Pre, 12 months Post)

Input: Pre-Period - 2, 7, 5, 6, 5, 5, 4, 4, 3, 5, 5, 8
Post-Period - 11, 2, 10, 7, 5, 5, 3, 2, 10, 8, 4, 5

Output:

Walker-Lev 1

F ratio: 1.006 with 1, 20 d.f,, not statistically significant

Walker-Lev 2

F ratio: .106 with 1, 20 d.f., not statistically significant

Walker-Lev 3

F ratio: .649 with 1, 21 d.f., not statistically significant

Mood Test

t = -2.79, significant at $p < .01$

Double Mood Test

t = .81, not statistically significant

Pre Data Regression Equation: $\hat{Y} = 4.258 + .101 (X)$
Post Data Regression Equation: $\hat{Y} = 7.318 - .203 (X)$

Interpretation: The Mood test indicates that the first post-period monthly burglary total is significantly higher than expected. Expected = 5.6, Actual Value = 11. No consistent change in slope or intercept for the entire Control group series is evident.

Tables C-3 through C-9 describe the results of the jursidiction-wide discontinuity analysis for Multnomah and Clackamas County.

Interpretation: The Walker Lev 1 test indicates that there was a statistically significant decline in the county's commercial burglaries during the first 12 month post-program period. The Double Mood test indicates that the post data regession line begins at a significantly higher level, but declines at a faster rate than the pre-program data. (See Figure 8) Walker Lev 2 reveals that the entire 30 month pre/post time series has a downward slope which is significantly different from zero.

Ir

TABLE C-4

Clackamas County Pre/Post Regression
Discontinuity Analysis

(18 Months Pre, 12 Months Post)

Input: Pre-Period: 87, 50, 51, 43, 51, 45, 55, 65, 54, 36, 48, 69, 37, 42, 44, 54, 44, 46

Post-Period: 44, 47, 48, 41, 40, 36, 35, 51, 36, 25, 30, 36

Output:

Walker-Lev 1

F ratio: .259 with 1, 26 d.f., not statistically significant

Walker-Lev 2

F ratio: 6.448 with 1, 26 d.f., significant at p<.025

Walker-Lev 3

F ratio: .198 with 1, 27 d.f., not statistically significant

Mood test

t = -.11, not statistically significant.

Double Mood Test

t = .58, not statistically significant

fN-Data Regression Equation: $\hat{Y}$ = 59.725 - .901 (X)
Post-Data Regression Equation: $\hat{Y}$ = 48.06 - 1.38 (X)

Interpretation: No significant difference in the post-period slope or intercept. However, Walker-Lev *2* indicates that the overall, pre/post slope is significantly different from zero. This strongly suggests consistent decline over the entire 30-month period.

TABLE C-5

Multnomah County Pre/Post Regression
Discontinuity Analysis

(18 Months Pre, 18 Months Post)

Input: Pre-Period **90, 91, 77, 78, 73, 76, 80, 79, 79, 84, 89, 70, 88, 64, 89, 76, 64, 84**

Post-Period 87, 90, 72, 86, 89, 105, 82, 67, 52, 60, 72, 63, 90, 84, 74, 70, 92, 69

Output:

Walker-Lev 1

F ratio: .124 with 1 and 32 cf.f., not statistically significant

Walker-Lev 2

F ratio: 2.351 with 1 and 32 d.f., not statistically significant.

Walker-Lev 3

F ratio: 1.310 with 1 and 33 d.f., not statistically significant.

Mood Test

t = -1.25, not statistically significant

Double Mood Test

t = 1.13, not statistically significant

Pre-Data Regression Equation: $\hat{Y} = 83.53 - .424 (X)$

Post-Data Regression Equation: $\hat{Y} - 84.43 - .677 (X)$

Interpretation: No significant change in Multnomah County's 18-month post-program burglary trend or level. However, the general downward trend is continuing at a slightly accelerated rate (pre-slope: -.424, post-slope: -.677).

TABLE C-6

Clackamas County Pre/Post Regression
Discontinuity Analysis

(18 Months Pre, 18 Months Post)

Input: Pre-Period 87, 50, 51, 43, 51, 45, 55, 65, 54, 36, 48, 69, 37, 42, 44, 54, 44, 46

Post-Period 44, 47, 48, 41, 40, 36, 35, 51, 36, 25, 30, 36, 50, 25, 32, 50, 35, 50.

Output:

Walker-Lev 1

F ratio: .917 with 1, 32 d.f., not statistically significant

Walker-Lev 2

F ratio: 3.0 with 1, 32 d.f., not statistically significant

Walker-Lev 3

F ratio: .029 with 1, 33 d.f., not statistically significant

Mood Test

t = -.11, not statistically significant.

Double Mood Test

t = .17, not statistically significant.

Pre-Data Regression Equation: $\hat{Y}_A = 59.725 - .901\ (X)$

Post-Data Regression Equation: $Y = 42.02 - .265\ (X)$

Interpretation: No statistically significant change in Clackamas County's 18-month post-period burglary trend or level. The post-slope for Multnomah County's 18-month series (Table C-5) showed an insignificant decline, while the above data indicates an insignificant tapering-off in Clackamas County's slope, (pre-slope: -.901, post-slope: -.265).

TABLE C-7

Multnomah County Pre/Post Regression
Discontinuity Analysis

(18 Months Pre,' 27 Months Post)

Input: Pre-Period 90, 91, 77, 78, 73, 76, 80, 79, 79, 84, 89, 70, 88, 64, 89, 76, 64, 84

Post-Period 87, 90, 72, 86, 89, 105, 82, 67, 52, 60, 72, 63, 90, 84, 74, 70, 92, 69, 59, 87, 94, 77, 73, 69, 84, 80, 84

Output:

Walker-Lev 1

F ratio: .242 with 1 and 41 d.f., not statistically significant.

Walker-Lev 2

F ratio: .727 with 1 and 41 d.f., not statistically significant.

Walker-Lev 3

F ratio: .276 with 1 and 42 d.f., not statistically significant.

Mood Test:

t = -1.25, not statistically significant

Double Mood Test

t = .65, not statistically significant

Pre-Oata Regression Equation: Y_A = 83.53 - .424 (X)

Post-Data Regression Equation: Y - 80.168 - .142 (X)

Interpretation: No significant jurisdiction-wide change in the direction or level of Multnomah County's monthly commerical burglary totals.

TABLE C-8

Clackamas County Pre/Post Regression
Discontinuity Analysis

(18 Months Pre, 27 Months Post)

Input: Pre-Period 87, 50, 51, 43, 51, 45, 55, 65, 54, 36, 48, 69, 37, 42, 44, 54, 44, 46

Post-Period 44, 47, 48, 41, 40, 36, 35, 51, 36, 25, 30, 36, 50, 25, 32, 50, 35, 50, 47, 53, 57, 57, 54, 46, 43, 49, 37

Output:

Walker-Lev 1

F ratio: 5.707 with 1, 41 d.f., significant at $p < .025$

Walker-Lev 2

F ratio: .070 with 1, 41, d.f. not statistically significant.

Walker-Lev 3

F ratio: 2.568 with 1, 42 d.f., not statistically significant.

Mood Test

t = -.11, not statistically significant

Double Mood Test

t = .81, not statistically significant

Pre-Data Regression Equation: $\hat{Y} = 59.725 - .901 (X)$
Post-Data Regression Equation: $\hat{Y} = 37.886 + .347 (X)$

Interpretation: There has been a statistically significant increase in the slope of the post-period burglary series (Pre-slope: -.901, Post-slope: +.347). However, a significant autocorrelation of the residuals (Ourbin Watson = 1.36) inflated the F ratio, invalidating this finding. See Table C-9 for corrected analysis.

TABLE C-9

Clackamas County Pre/Post Regression
Discontinuity Analysis

(Data Transformed to Correct for Autocorrelation
of the Residuals, 18 Months Pre, 27 Months Post)

Input: Pre-Period: 83.5, 25.9, 37.1, 28.9, 39.1, 30.9, 42.5, 49.8, 35,9, 21, 38, 55.7, 27.9, 31.8, 32.4, 41.8, 29, 33.8

Post-Period: 31.3, 34.8, 34.9, 27.7, 28.6, 24.9, 25, 41.3, 21.9, 15, 23.1, 27.7, 40, 11.1, 25.1, 41,1, 21.2, 40.3, 33.2, 39.9, 42.3, 39.2, 38.8, 31, 30.3, 37.9, 23.4

Output:

Walker-Lev 1

F ratio: 3.389 with 1, 41 d.f., significant at p> .05 and <.1O.

Walker-Lev 2

F ratio: .001 with 1, 41, d.f., not statistically significant.

Walker-Lev 3

F ratio: 1.328 with 1, 42 d,f., not statistically significant.

Mood Test

t = - .05, not statistically significant

Double Mood Test

t = .52, not statistically significant

Pre-Data Regression Equation: $\hat{Y} = 45.603 - .794(X)$

Post-Data Regression Equation: $\hat{Y} = 26.361 + .244\ (X)$

Interpretation: After correcting for the significant autocorrelation in the original data, the original significant increase in the post period fell to statistical insignificance. Although not quite statistically significant, Walker-Lev 1 remains high enough to be of practical significance (F ratio: 3.389, slope change: pre = -.794, post = +.244). This suggests a nearly significant increase in the Clackamas County commercial burglary trend during the post period.

Test of Residua] Autocorrelation

Significant autocorrelation in the residuals (correlation between each error and its corresponding "lag 1 error) has the effect of substantially increasing the F ratio used to test change in the pre/post time series.2 if a significant autocorrelation is detected, the original data must be transformed to reduce the autocorrelation before ordinary least squares discontinuity analysis can be applied.3

To test for residual autocorrelation, the 24 months of Target-Control data was calculated and tested using the Durbin-Watson statistic. The following results were obtained:

Group	Durbin-Watson ' Statistic (lag 1 residual)	Significance
Target 10 months Pre + 12 Month Post (N = 22)	2.01	2.01> $D.W._u$ (1.41) No autocorrelation
Control 12 months Pre + 12 month Post (N = 24)	1.93	1.93> $D.W._U$ (1.45) No autocorrelation

2 Error here refers to the difference between the predicted and actual monthly burglary totals.

3 Autocorrelation, its effect on the discontinuity analysis, and ways of correcting for it are explained in Schneider (9) and Ostrom (7).

Next, the county-wide monthly burglary totals were tested for first-order residual autocorrelation. Their respective Durbin Watson statistics are:

Group	Durbin-Watson Statistics (lag 1 residual)	Significance
Multnomah County (N = 45 months, entire pre/post series)	1.54	1.54 is $>D.W._L$ and $< D.W._u$ therefore questionable autocorrelation.
Clackamas County (N = 45 months, entire pre/post series)	1.36	1.36 is $<D.W._L$ therefore, definite autocorrelation

Multnomah County yielded a marginal autocorrelation at the p = .05 level and no autocorrelation at the p = .025 level. It was decided not to transform the original monthly data.

On the other hand, Clackamas County's data presented a highly significant (p< .01) first-order residual autocorrelation. It was decided to transform the monthly burglary totals according to the method of generalized least squares.[4] Here, all 45 monthly burglary totals were transformed from Y_t to Y_t' *by* using the following equation:

$$V = Y'_t - (P)\ (Y_t - 1)$$

[4] This technique is described by Ostrom (7: 35-38).

Where,

Y'_t = The transformed monthly total for t 1 through t 45.

Y_t = The original monthly total for t 1 through t 45

p = The coefficient of correlation between the residuals and their corresponding lag 1 residuals.

Y_{t-1} The original monthly total at lag 1 for t 2 through t 45.

The transformed monthly totals were then retested for first-order autocorrelation.

Group	Durbin-Watson Statistics (lag 1 residual)	Significance
Transformed (Y^1) Clackamas County Monthly Totals (N = 45)	**1.73**	1.73 is>$D.W._u$ (**1.61**) therefore, no significant autocorrelation.

Since all of the Durbin-Watson statistics with the exception of Clackamas County, indicate no siginificant autocorrelation, the results of the Walker-Lev time series can be viewed with greater confidence for the Target and Control and the county-wide analyses. For Clackamas County the transformed monthly totals were corrected for their autocorrelation and the analysis presented in Table C-9 is valid.

APPENDIX D

PREMISE SURVEY INSPECTION REPORT

PRELIMINARY QUESTIONNAIRE

FOLLOW-UP QUESTIONNAIRE AND CORRESPONDENCE

MULTNOMAH COUNTY DIVISION OF PUBLIC SAFETY
COMMUNITY AFFAIRS/CRIME PREVENTION UNIT
COMMERCIAL BURGLARY PREVENTION
PREMISE INSPECTION REPORT

Business Name: Acme Furniture File # 78-381

Business Address: 127 S.E. Washington Date: 1/18/78

Type of Business: Retail Store Team: 5

Telephone: 123-8765

Owner or Manager's Name: Jim Shorter Contact: Manager

Officer: B. Guest BPST # 1989

INFORMATION IN THIS REPORT IS CONFIDENTIAL. FOR USE BY CRIME PREVENTION UNIT AND CLIENT ONLY.

This report is part of a crime prevention program conducted by the Multnomah County Sheriff's office to help you protect yourself against burglary. If you follow the recommendations, you will substantially reduce the opportunity for a burglary to be committed at your business.

YOU NEED TO MAKE THESE CORRECTIONS

LARM SYSTEM:

onsider adding a central station silent-remote notification feature to the existing larm system. Relying on someone to call in the alarm is not practical, considering he potential loss that exists if no one calls in to report the alarm or it is ilenced by the burglars.

ee the enclosed brochure for additional information about central station monitoring ervices.

DDRESS:

e sure address numbers are posted on front and rear of building. Numbers should be least 4" high and well-lit at night.

IGHTING:

ll parking, loading and activity areas should be lighted during hours of darkness ith a minimum maintained light of 2 foot candles. Care must be taken on either nterior or exterior lighting applications so as not to blind passersby or patrols ith glare from improperly installed lights. The address should be illuminated during ours of darkness at both the front and rear opening.

"See next page"

MONEY HANDLING:

Vary times bank deposits are made and if possible, have two people make night deposits, one watching while the other makes the deposit.

PROPERTY IDENTIFICATION:

Engrave property and equipment with either owner's Oregon driver's license number as shown: OR123456DL, business' social security number preceded by "SSN" or employer identification number (federal withholding tax) preceded by "EIN." Inventory marked property. Record serial numbers. Post decals on all points of entry.

PRELIMINARY QUESTIONNAIRE

Name of Business ACME FURNITURE

Address 127 S.E. Washington Portland

Type of Business Retail Store

Have you been burglarized in the past two years? YES (NO)

Attempts 1 2 3 4 5 6 7 8 9
Completes 1 2 3 4 5 6 7 8 9

For each burglary or attempt, can you remember?

Month _____ Day _____ Dollar Loss _____

Did you initiate any precautions following the burglary? _____

Month _____ Day _____ Dollar Loss _____

Did you initiate any precautions following the burglary? _____

Month _____ Day _____ Dollar Loss _____

Did you initiate any precautions following the burglary? _____

COMPLIANCE QUESTIONNAIRE

Name of Business ACME FURNITURE

Address 127 S.E. Washington Portland

Type of Business Retail Store

Date of Survey 1-6-78

Date of Questionnaire 8-28-78

A premise survey was performed for you six months ago. It recomended that you do the following things in your business to make it more secure:

1. Expand Audible Alarm to include silent back-up system
2. Post address on front
3. Lighting at night
4. Night bank deposit boxes
5. Property I.D.

Could you tell me what you have completed?

1. 2
2. 3
3. 4
4.
5.

Have you been burglarized since the premise survey? YES (NO)

For each burglary or attempt, can you remember?

Month _____ Day _____ Dollar Loss _____

Attempt or Complete _____

Were preventive changes made before or after burglary incident?

MULTNOMAH COUNTY OREGON

OFFICE OF THE CHAIRMAN
BOARD OF COUNTY COMMISSIONERS
ROOM 606 COUNTY COURTHOUSE
PORTLAND, OREGON 97204
(503) 248-3308

Thank you for participating in the Crime Prevention Unit's premise survey program. The loss prevention recommendations enclosed have been carefully considered to provide you with a cost effective way to reduce your risk of becoming a burglary victim.

I hope that you will aggressively implement these recommendations to protect your business and continue to assist the Sheriff's neighborhood police officer in reducing criminal opportunities in your neighborhood.

The Sheriff's Crime Prevention Unit has worked with thousands of citizens to make our community a safer place to live and work. I encourage you to contact them at 255-7422 and ask about their other programs.

Cordially,

Donald E. Clark, Chairman
Board of Commissioners

DEC/kb
Enclosure