Illuminating Crime: The Impact of Street Lighting on Calls for Police Service

Kenna Davis Quinet and Samuel Nunn

Eval Rev 1998; 22; 751
DOI: 10.1177/0193841X9802200603

This study reports on an evaluation of the effects of street lights on crime in several Indianapolis neighborhoods. Crime was measured in terms of calls for police service (CFS). Using a quasi-experimental design, we performed analyses on four multiblock areas, three intersections, and two aggregated address groups. Two control areas were matched to two multiblock areas that received enhanced lighting. Of the nine target areas, six showed evidence of lower CFS volumes after more lighting. We analyzed the mean weekly CFS in the pre- and postinstallation periods. Two lighted areas had a lower mean weekly CFS after installation. The more illuminated target area experienced a greater reduction in average CFS for property and miscellaneous crimes than did the control area.

ILLUMINATING CRIME

The Impact of Street Lighting on Calls for Police Service

KENNA DAVIS QUINET
SAMUEL NUNN
Indiana University

Although it is commonly assumed that street lighting deters criminal activity, there are relatively few studies that have scientifically assessed the impact of lighting on crime. Much of the information concerning the impact of lighting on crime is anecdotal: Police, neighborhood organization members, and city planners simply feel better about well-lit neighborhoods. Beginning in July 1995, however, an opportunity arose to evaluate the impact of newly installed street lights on a sample of neighborhoods in the city of Indianapolis. The local electrical utility had joined forces with block clubs and neighborhood organizations in the Near Eastside Community Organization, Inc.

AUTHORS' NOTE: *This research was supported by the Center for Urban Policy and the Environment, School of Public and Environmental Affairs, Indiana University, from funds provided by the Indiana Electric Association. The exemplary research skills of Kelley Gaffney, Tamara Helbert, and Joseph B. Rubleske were integral to the completion of this project and are greatly appreciated.*

EVALUATION REVIEW, Vol. 22 No. 6, December 1998 751-779

(NESCO) area in an effort to increase lighting in several neighborhoods. New lights were installed in a variety of areas, and approximately 12 months later, we conducted an evaluation of the effects of the installation of street lights on crime and disorder in the NESCO area.

The objective of this evaluation was to determine what impact, if any, the installation of street lighting in a sample of neighborhoods has had on the number of crimes as measured by calls for service (CFS). We selected a sample of target sites from the NESCO area; these sites were chosen based on the number of CFS, the potential for matching to a control area, and the veracity of light locations. We found several areas that received additional lighting where there was virtually no crime before or after installation of the lights, thus not allowing for any statistical analysis of impact. Because of the small numbers of events (CFS) at the specific installation locations, we aggregated groups of lights into larger, more meaningful spatial areas. We performed analyses on four different areas of NESCO (Areas A-D), three intersections, and two aggregated address groups. Two different approaches were used to assess the impact of lighting. First, we analyzed areas, intersections, and groups for changes in the raw count of CFS before (pre) and after (post) the installation of additional lights. We realized that we had, at best, a quasi-experimental design, because we were not looking at areas that had no lights and then a lot of lights but rather a continuum of less to more lighting. Accordingly, we selected two areas (A and C) against which to match experimental control areas that had fewer lights (A2 and C2). The goal of using A2 and C2 was to allow assessment of CFS over time in areas close to our lighting intervention areas that had similar crime rates and similar sociodemographic characteristics. The control areas had not received added lighting and served as a baseline comparison against which to measure the pre- and post-lighting changes in the target neighborhoods.

The data used to measure crime was drawn from the Indianapolis Police Department's (IPD) database. We selected CFS as the dependent variable rather than arrests because it presents a more valid measure of neighborhood crime and disorder. From the CFS-run data, we created substantively meaningful crime categories. Our intent was to measure changes in several categories, ranging from violent and property crimes to vehicular/traffic crimes. The appendix details the criminal complaint categories used to reduce 66 CFS codes to 11 general categories of reported crime. The CFS database was extracted for the specific spatial areas of study, for particular crimes, and only for crimes occurring at night (the only meaningful time period to use when assessing the impact of lighting).

REVIEW OF LITERATURE AND ASSESSMENT OF ISSUES

Under a rational choice model (Siegel 1995), increased lighting should make areas more visible and thus less attractive to potential offenders. This assumes that potential offenders will minimize their risks of apprehension and avoid areas in which the likelihood of identification is higher. Support for this hypothesis would generate findings of decreased CFS after the installation of lighting. Alternatively, if these potential offenders are not afraid of being viewed by residents and police, there could be little deterrent impact of lighting on actual criminal activity (no effect); however, there could still be positive impacts in terms of residents' perceptions of safety or their use of theses areas. Third, we could find no actual change in offender behavior but still find an increase in CFS from residents after the installation of street lights due to the resident's increased visibility of activity.

Given this range of alternative hypotheses, it is not surprising that analyses of the effect of street lighting on crime find mixed results. Moreover, many studies encounter problems because they may lack follow-up periods of sufficient length, inadequate numbers of crimes or crime categories, no consideration of seasonal or temporal effects, or other potential public safety initiatives that may mask street lighting effects (see Tien et al. 1977). Despite these potential flaws, street lighting studies can be grouped generally in terms of those that found impacts and those that did not.

According to Evans, Fyfe, and Herbert (1992), street lighting decreases the incidence of crime and personal harassment and also decreases people's apprehensions about being victimized. Evans found that the level of public confidence, the perception of personal safety at night, and pedestrian traffic flow on the streets and sidewalks all increased with street lighting. Kaplan et al. (1978) reported that improved street lighting eliminated two of the four intermediate goals of criminal activity: access control strategies and surveillance strategies. This reduces crime in general by making targets more difficult to victimize and enhancing the view of legitimate users of the area.

Some of the effects of street lighting are crime specific. In Atlanta, when the city installed new street lights in high crime areas, the number of burglaries diminished (City of Atlanta 1975). However, no other crime was significantly affected. In a study of the incidence of assault, auto crime, and threats, Painter (1990) tracked these specific crimes 6 months prior to and 6 months after increased street lighting. Prior to the installation of lighting, there were 21 incidents; after installation of lighting, there were only three incidents. Thus, Painter concluded that street lighting reduced the incidence of assault,

auto crime, and threats and also indicated that the impact of street lighting is much greater on women than it is on men. According to Poyner (1981), the illumination of parking lots is a definite ingredient of success in the reduction of car theft. In a study done by Challinger (1991), the focus was on public telephones placed in dark or quiet areas. When the booth lighting was increased to a level at which the booth was visible and identifiable from 400 meters away, the incidence of vandalism diminished. Other findings from this study included an increase in the use of the previously dark phones and increased visibility of the people using them. Challinger concluded that this evidence supported the idea that lighting may make places safer.

Several studies based on interview data show possible positive impacts from street lights. Vrij and Winkel (1991) analyzed differences in the feelings of safety between a control group (with minimum lighting) and an experimental group (with five times the lighting), concluding that improved street lighting will increase feelings of safety, reduce the likelihood of victimization, and encourage people to help others when needed. Similarly, Ditton and Nair (1994) reported that their interviews found victimization declined, nighttime pedestrian movement increased, and fear levels declined somewhat. Based on a pre-/postinterview format, Painter (1994) concluded that crime, disorder, and fear of crime were reduced, and nighttime street activity increased. Using pre-/postvictimization surveys, Painter and Farrington (1997, 209) "found clear evidence that crime of all kinds decreased significantly in the re-lit estate compared with the control."

Other studies conducted on the effects of street lighting find very little or no impact. For example, in an evaluation of the effects of lighting in Kansas City, Wright and Heilweil (1974) found significant reductions in violent crime and relatively insignificant reductions in property crime. Reppetto (1974) compared different levels of street lighting in Boston and reported no correlation between lighting and burglary or robbery. In a study done by Tien et al. (1977), 40 studies and 15 street lighting programs were reviewed, and the results were mixed. Seven studies reported increases in certain crime categories, 3 produced increased overall crime levels, and 7 found no change in crime. The only definite finding generated was that residents feel safer as a result of more street lighting. But even this finding does not always hold. After criticizing the use of pre-/postinterview techniques to assess the impact of lighting, Nair, Ditton, and Phillips (1993) concluded that the effects of improved street lighting cannot be guaranteed because the effects are tied to a whole range of environmental improvements; they found that a significant increase in feelings of local safety was not produced. Likewise, Atkins, Husain,

and Storey (1991) found no evidence that improved street lighting reduced crime or fear of crime.

Some studies attempted to measure the positive effects of street lighting but could not hold one variable constant. Poyner and Webb (1987) did a study intended to reduce the amount of theft from shopping bags in the worst affected city center markets. They not only increased the lighting by installing a new lighting system, but they also widened the spaces between market stalls in the markets. The result of these two actions substantially decreased the amount of theft that occurred in those city center markets. The only problem is that we do not know how much of an impact the increased lighting alone had on the reduction of theft, but we do know that the lighting was a factor in the reduction of theft. Another example of this type of study is a time series analysis done by Griswold (1984). Focusing on commercial burglary, Griswold concluded that the rates of burglary were reduced by a combination of security surveys and increased street lighting. Consequently, both may be needed to produce the same success in crime reduction.

As this review shows, previous literature finds mixed results concerning the impact of lighting on actual crime, in part due to a number of potential contaminating effects on the impact of lighting. First of all, many crimes (particularly domestic crimes) occur inside the home and would obviously not be deterred by lighting. One could hypothesize that, unless lighting is actually attached to the particular domicile in question, the impact of deterring rapes, burglaries, or vandalisms may be negligible at best. Thus, assessments of the impact of lighting should create crime categories that are substantively meaningful to the question at hand.

Obviously, enhanced lighting should function only to deter crimes that would have occurred after dark, unless offenders choose to conduct their daytime activities at the same place and the undesirability of a well-lit location at night would also displace possible similar activities during the day. In addition, in many areas where residents request additional lighting, this request may be the result of an increase in crime in the area, and thus, (a) there may be criminogenic elements amidst that are much more powerful than the impact of lighting, and (b) in addition to requests for lighting, residents may also request increased police services. For instance, in the NESCO area during the period that street lights were being installed, there was a variety of IPD initiatives in this area that increased police presence and increased the likelihood of arrest for traffic, gun, and drug offenses. In our analysis, the areas and dates of these intervention programs were identified and extracted from the database to avoid contamination effects. In addition, we examined these catego-

ries after the intervention dates and provide a separate analysis of these trends.

METHODOLOGY AND AREA DESCRIPTIONS

Data for the analysis were drawn from CFS by citizens to the police. The use of CFS as a dependent variable in criminal justice research has become increasingly widespread. Recently, Kessler and Duncan (1996) used CFS to assess the impact of community policing in Houston. Thurman, Giacomazzi, and Reisig (1996) examined gang intervention strategies by means of changes in CFS during weekends. Numerous other analyses have examined changes in CFS associated with public safety initiatives (Weisburd and Green 1995; Brooks, Piquero, and Cronin 1994; Cohn 1993). The logic of the CFS variable is that it offers a reasonable, effective, and consistently obtainable measure of citizens' demand for police assistance.

In this regard, an issue to consider is how CFS are generated within the IPD. Calls for service are almost entirely generated by citizens—approximately 95% of police work is reactive (Reiss 1971). Thus, a small number of CFS logged into the system are generated by an officer who sees a crime in progress. The complicating factor in regards to the generation of CFS is not so much the *who* but the *where*. Calls may originate from the victim's or complainant's residence, and if they do not have the exact location of the incident, it is the complainant's address that is logged into the system. As a result, all CFS do not necessarily reflect the exact location of the incident. Also, many residents do not have phones and use convenience store phones located near their residence—unless the caller gives the dispatcher the location of the incident, the incident will appear to have been at the place of the call rather than the offense. This problem cannot be totally eliminated, although we did investigate the actual locations of addresses that exhibited very high levels of CFS (e.g., a convenience store parking lot with a pay phone).

Initially, four study areas—A, B, C, and D—were formed around aggregations of NESCO street lights. Areas A and B, separated by two blocks, are linear corridors, each consisting of one street bounded at the north and south. Area A is two blocks long, whereas Area B is one block long. Area C, unlike Areas A and B, consists of one north-south block and two east-west blocks. Area D is bounded by five streets and encompasses more area than A, B, or C. Seven additional study areas were then formed. Two of these—Control Areas A2 and C2—served as control groups for Areas A and C so that changes in CFS could be examined in areas without NESCO lights. Attempts were made

to control for other factors such as demographic differences (Areas A and C are located close by but not adjacent to their control groups) and parcel density (Areas A and C contain the same number of parcels as their control groups). Three additional study areas each consisted of a single intersection (INT1, INT2, and INT3). Two final study areas were comprised of groups of individual addresses—with each address containing a NESCO light—that were aggregated according to their installation dates. The study area named Address 1 includes 12 addresses (and 13 lights) and all NESCO lights installed between September 18 and 20, 1995. Address 2 includes 11 addresses (and 11 lights) and all NESCO lights installed between July 25 and August 24, 1995. Altogether, 11 study areas were identified and isolated for analysis.

This analysis does not consider displacement or diffusion effects. We believe an analysis of patterns of displacement or diffusion of crime is nonsensical to a quasi-experimental design. If one argues that control areas are free from intervention and can be matched to the experimental areas, then there should be no displacement of effects from the experimental to the control area. Either you have a control area free of influences from the experimental area, or you do not. In addition, because the control areas were not adjacent to the experimental areas, displacement and diffusion were unlikely.

On defining study areas, field surveys were made to confirm the existence of all documented street lights, including NESCO lights, and to identify any street lights not yet documented. On locating all NESCO lights and all non-NESCO street lights, we were able to quantify the total number of street lights located within each study area. Table 1 summarizes the results of the study area canvass.[1]

The 11 study areas contain 100 street lights, 50 of which are leased by NESCO. Of Areas A through D (including control groups), only Area A contains more NESCO lights than non-NESCO lights. Excluding intersections, Control Area A2 has the fewest total street lights (6). Area D, which comprises the greatest total area relative to other study areas, contains the most street lights (17).

Although field surveys of study areas were conducted, we obtained CFS data for each of the 11 study areas from the IPD RUNINFO database. To generate CFS data, we specified each study area's geographic boundaries and relevant time frames. The 11 original data sets (corresponding to the 11 study areas) included numerous data, much of which was eliminated from subsequent analysis.[2] From here, we performed the following tasks:

- Complaint types not relevant to the study were removed (see the appendix).
- Complaints that occurred during daylight hours were removed.
- Duplicated complaints were removed.

TABLE 1: Results of the Study Area Canvass

Study Area	Number of NESCO Street Lights	Number of Other (non-NESCO) Street Lights	Total Number of Street Lights
A	6	3	9
B	3	7[a]	10
C	6	8	14
D	7	10	17
A2 (control)	0	6	6
C2 (control)	0	16[a]	16
Intersection 1	2	0	2
Intersection 2	1	0	1
Intersection 3	1	0	1
Address 1	13	0	13
Address 2	11	0	11
Total	50	50	100

NOTE: NESCO = Near Eastside Community Organization, Inc.
a. Area B contains a restaurant in its northwest corner that has two parking lot lights. Area C2 contains a used car dealer in its southeast corner that has 11 parking lot lights.

RAW COUNT ANALYSIS

AREA A AND CONTROL AREA A2

Area A is comprised of two linear blocks. Six NESCO lights were installed in Area A between July 1, 1995, and December 5, 1995. To examine what crime was being reported in another area that did not receive NESCO lights, a control area (A2) was established that was similar to Area A but did not have enhanced street lighting. Low volumes of CFS indicate both areas exhibit low crime levels, which makes it difficult to discern any clear impacts from enhanced lighting. Comparative raw counts of CFS are reported in Table 2. Area A had 10 CFS before NESCO lights, but the CFS volume increased to 21 calls after installation. Most of this increase was the result of the disturbance category, which doubled from 7 to 14 CFS. Excluding the disturbance category results in a change of three CFS to seven CFS from the preinstallation to the postinstallation period. During the same periods, CFS volume in control Area A2 declined from 20 to 16, which is also accounted for largely by a decline in the disturbance category. If disturbances are excluded, Area A2 exhibited a slightly higher volume of CFS than Area A, with 8 CFS and 10 CFS in the pre- and postinstallation periods, respectively. Based on the raw counts of CFS in Area A and A2, the NESCO lighting installation in

TABLE 2: Raw Counts of Calls for Service—Area A and Control Area A2

Complaint Categories	*Preinstallation*	*Postinstallation*	*Total*
Area A (NESCO lighting)			
Accidental	0	1	1
Burglary	0	2	2
Disturbance	7	14	21
Drugs	0	0	0
Gun	1	2	3
Surveillance	2	0	2
Person	0	0	0
Robbery	0	1	1
Traffic	0	1	1
Vandalism	0	0	0
Vehicular	0	0	0
Total	10	21	31
Control Area A2 (no NESCO lighting)			
Accidental	0	1	1
Burglary	0	0	0
Disturbance	12	6	18
Drugs	0	0	0
Gun	2	2	4
Surveillance	1	2	3
Person	2	0	2
Robbery	0	1	1
Traffic	3	4	7
Vandalism	0	0	0
Vehicular	0	0	0
Total	20	16	36

NOTE: NESCO = Near Eastside Community Organization, Inc. Preinstallation was December 6, 1994, to June 30, 1994. Postinstallation was December 6, 1995, to June 30, 1996. The table excludes addresses outside area but does not exclude IPD intervention dates, because the majority of intervention CFS occurred during installation period (already excluded).

the Area A street segment does not appear to have had a noticeable effect on CFS volume. In any event, the very low volumes of reported CFS indicate that both these areas exhibited modest crime levels in the first place, which makes it difficult to discern any clear impacts from enhanced lighting.

AREA B

Area B is comprised of a single block. Three NESCO lights were installed in Area B between July 1, 1995, and December 5, 1995. No control area was used as a comparison. Comparative raw counts of CFS in Area B are reported

TABLE 3: Raw Counts of Calls for Service—Area B

Complaint Categories	*Preinstallation*	*Postinstallation*	*Total*
Area B (NESCO lighting)			
Accidental	1	0	1
Burglary	4	4	8
Disturbance	17	12	29
Drugs	0	1	1
Gun	1	1	2
Surveillance	1	0	1
Person	2	2	4
Robbery	0	0	0
Traffic	3	4	7
Vandalism	3	0	3
Vehicular	1	0	1
Total	33	24	57

NOTE: NESCO = Near Eastside Community Organization, Inc. Preinstallation was from December 6, 1994, to June 30, 1995. Postinstallation was from December 6, 1995, to June 30, 1006. The table excludes addresses outside study area but does not exclude IPD intervention dates, because the majority of intervention CFS occurred during installation period (already excluded).

in Table 3. Total CFS dropped from 33 in the preinstallation period to 24 after the NESCO lights were installed. Most of this decline (five CFS) was in the disturbance category. Although there were no or only minor changes in most of the other CFS categories, the vandalism category dropped from three CFS before the NESCO lights to no CFS after installation. Based on the raw counts of CFS in Area B, the NESCO lighting installation might have had a slight effect on CFS volume due to the reduction in disturbance calls and vandalism.

AREA C AND CONTROL AREA C2

Area C is comprised of a multiblock area. Six NESCO lights were installed in Area C between July 1, 1995, and September 1, 1995. Control Area C2 is located approximately one and one half blocks from Area C. There are similar numbers of parcels in Areas C and C2. Comparative counts of CFS are reported in Table 4. Observations about Areas C and C2 are considered in two ways because the IPD was engaged in special public safety interventions during some of the time periods under analysis here. Therefore, one analysis of C and C2 ignores any possible effects of the special interventions, whereas the second analysis specifically excludes the dates of the interventions.

TABLE 4: Raw Counts of Calls for Service—Area C and Control Area C2

Complaint Categories	*Preinstallation*	*Postinstallation*	*Total*
Area C (NESCO lighting)			
Accidental	4	4	8
Burglary	14	14	28
Disturbance	92	95	187
Drugs	2	3	5
Gun	9	24	33
Surveillance	12	12	24
Person	9	4	13
Robbery	5	3	8
Traffic	9	49	58
Vandalism	3	1	4
Vehicular	3	1	4
Total	162	210	372
Control Area C2 (no NESCO lighting)			
Accidental	0	1	1
Burglary	4	3	7
Disturbance	21	35	56
Drugs	0	0	0
Gun	1	5	6
Surveillance	6	4	10
Person	2	3	5
Robbery	0	2	2
Traffic	7	24	31
Vandalism	0	0	0
Vehicular	1	1	2
Total	42	78	120

NOTE: NESCO = Near Eastside Community Organization, Inc. Preinstallation was from September 2, 1994, to June 30, 1995. Postinstallation was from September 2, 1995, to June 30, 1996. The table excludes addresses outside study area. Indianapolis Police Department intervention dates are included.

Including IPD Intervention Dates

Area C exhibited a high volume of CFS in both the preinstallation and postinstallation periods. Total CFS increased from 162 to 210 (48 CFS or +29.6%). However, two CFS categories, traffic and guns, accounted for all of this change, increasing by 53 CFS between the prelighting and postlighting periods. As shown below, these were some of the targets of the special IPD initiatives. If the traffic and gun categories are excluded, the total CFS in Area C declined slightly between the pre- and postlighting periods, from 144 to 137 CFS.

Control Area C2 exhibited a smaller volume of CFS than Area C, but it also showed an increase in call volume between the two periods (36 CFS or +85.7%). This was a considerably greater increase than in Area C. As in Area C, much of the pre-to-post change is explained by traffic and guns, which accounted for an increase of 21 CFS. If these two categories are excluded from the control area counts, the CFS volume in Area C2 still shows an increase from 34 to 49 calls. Thus, in terms of total CFS, if traffic and guns are excluded, control Area C2 increased by 44% from the preinstallation to the postinstallation period, whereas CFS volume in Area C (with additional NESCO lighting) decreased by 4.9%. In comparing the raw counts of CFS in Areas C and C2, enhanced street lighting may be having some effect as reflected in the different volumes and percentage changes in CFS, but because of the confounding effects of the concurrent IPD public safety initiatives, it cannot be concluded that the lights caused such changes.

Excluding IPD Intervention Dates

The IPD interventions targeted all sorts of crime in addition to traffic and gun violations, so other complaint categories could have been affected due to the increased police presence within the beats during the intervention efforts. This can mask the effects, if any, of enhanced street lighting. Accordingly, another method of accounting for special police initiatives is simply to exclude the dates of the initiatives from the analysis. The following observations are based on an analysis of Areas C and C2 without the CFS that were made during the dates of IPD interventions in the relevant police beats. Please note that the same weeks were excluded in the preinstallation period to maintain equal numbers of weeks in the pre- and postperiods. These are shown in Table 5.

When the CFS from the intervention dates are excluded, the remaining CFS volume in Area C still increased by nearly one third (+32.4%) from the preinstallation to the postlighting period. This is compared to just a 20.7% increase (from 29 to 35 CFS) between the same two periods in control Area C2. However, traffic and guns still reflect in Area C a substantial part of the increase (35 more CFS for these two offenses during the postlighting period). If the traffic and gun categories are excluded from the pre- and postlighting periods in Areas C and C2, the CFS volume in Area C remained stable (95 CFS in each period), whereas the volume of CFS in control Area C2 increases from 25 to 30 between the two periods. Thus, if the enhanced NESCO lighting installed in Area C actually influenced the volume of CFS, the impact is slight and only in comparison to control Area C2.

TABLE 5: Raw Counts of Calls for Service—Area C and Control Area C

Complaint Categories	*Preinstallation*	*Postinstallation*	*Total*
Area C (NESCO lighting)			
Accidental	3	2	5
Burglary	11	12	23
Disturbance	58	63	121
Drugs	2	3	5
Gun	8	18	26
Surveillance	8	10	18
Person	6	2	8
Robbery	3	1	4
Traffic	5	30	35
Vandalism	3	1	4
Vehicular	1	1	2
Total	108	143	251
Control Area C2 (no NESCO lighting)			
Accidental	0	1	1
Burglary	3	3	6
Disturbance	15	21	36
Drugs	0	0	0
Gun	1	2	3
Surveillance	5	0	5
Person	2	2	4
Robbery	0	2	2
Traffic	3	3	6
Vandalism	0	0	0
Vehicular	0	1	1
Total	29	35	64

NOTE: NESCO = Near Eastside Community Organization, Inc. Preinstallation was from September 2, 1994, to June 30, 1995. Postinstallation was from September 2, 1995, to June 30, 1996. The table excludes addresses outside study area. Indianapolis Police Department intervention dates are excluded.

AREA D

Area D is also comprised of a multiblock area. Seven NESCO lights were installed in Area D between July 1, 1995, and November 20, 1995. Comparative raw counts of CFS are reported in Table 6. Observations about Area D are also considered in two ways because the IPD was engaged in special public safety interventions during some of the time periods under analysis here. Therefore, one analysis of D ignores any possible effects of the special interventions, whereas the second analysis specifically excludes the dates of the interventions.

TABLE 6: Raw Counts of Calls for Service—Area D

Complaint Categories	*Preinstallation*	*Postinstallation*	*Total*
Area D[a] (NESCO lighting)			
Accidental	1	2	3
Burglary	8	5	13
Disturbance	25	17	42
Drugs	0	0	0
Gun	3	5	8
Surveillance	3	2	5
Person	1	5	6
Robbery	1	0	1
Traffic	2	3	5
Vandalism	2	0	2
Vehicular	1	0	1
Total	47	39	86
Area D[b] (NESCO lighting)			
Accidental	1	2	3
Burglary	6	3	9
Disturbance	17	11	28
Drugs	0	0	0
Gun	2	1	3
Surveillance	2	2	4
Person	0	3	3
Robbery	1	0	1
Traffic	2	3	5
Vandalism	1	0	1
Vehicular	1	0	1
Total	33	25	58

NOTE: NESCO = Near Eastside Community Organization, Inc. Preinstallation was from November 21, 1994, to June 30, 1995. Postinstallation was from November 21, 1995, to June 30, 1996. The table excludes addresses outside study area.
a. Indianapolis Police Department intervention dates are included.
b. Indianapolis Police Department intervention dates are excluded.

Including IPD Intervention Dates

Area D showed a reduction in CFS volume (47 to 39 CFS) from the prelighting to the postlighting period. This reflects a decrease of 17% in total CFS volume. These reductions occurred in the burglary (8 to 5 CFS) and disturbance (25 to 17 CFS) categories, both of which might be expected to decline if street lighting is enhanced. Another complaint area likely to be reduced by more street lights is vandalism, which indeed declined from two CFS in the preinstallation period to no reported incidents after additional NESCO lighting was installed.

Excluding IPD Intervention Dates

IPD intervention activity occurred in Area D between May 1, 1996, and June 30, 1996. These dates can be excluded on the basis that such initiatives will confuse identification of possible lighting impacts; these dates are also eliminated in the prelighting period to equalize the number of dates in the preinstallation and postinstallation periods. When this is done, a reduction in the CFS volume of Area D still is measurable in the postlighting period. Total CFS falls from 33 prior to the NESCO lighting additions to 25 after lights are installed. Most of the decline is explained by a reduction in the number of reported disturbances, from 17 to 11 CFS. In addition, the burglary category dropped by 50% (6 to 3 CFS) after the NESCO lights were installed. Thus, based on the raw counts, Area D offers some evidence that a substantial increase in street lights could be associated with a reduction in the total number of CFS.

INDIVIDUAL ADDRESS GROUPINGS

Another approach to measuring the impact of enhanced lighting is to take groups of individual addresses that installed a NESCO light and examine the CFS volume for the group of addresses prior to and after installation of the new lights. (Groups of addresses are used due to the low volume of activity at any single address.) Two sets of addresses were examined in this manner: one group of 12 addresses and another group of 11 addresses. As with the previous areas, two time periods (before and after the NESCO lights) are examined. One problem with this approach, as shown below, is the extremely low volumes of CFS reported for these addresses in either period. Because of this low volume, we are not presenting separate tables for the address groupings and are instead simply explaining the basic findings.

Address 1. This grouping of 12 addresses reported six CFS incidents before lights were installed and no incidents afterwards. For these addresses, it is interesting that all three categories of CFS that make up the six incidents (one burglary, three disturbances, and two acts of vandalism) are clearly the types of crime that enhanced lighting is designed to stop. This offers some evidence that, for individual address groupings at least, enhanced street lighting can be associated with a reduction in CFS.

Address 2. This grouping of 11 addresses that installed NESCO lights presents a similar situation, once the existence of a disturbance "hot spot"

(i.e., an address that has an extraordinarily high level of reported criminal activity) is recognized. The raw count shows CFS volume increased from 2 to 13 after lights were installed. However, the entire increase is explained by the disturbance CFS in the postlighting period. But out of the 11 disturbances, 10 of them are at a single address, and all but 1 of the incidents are domestic disturbances. Thus, if the disturbance hot spot at that address is eliminated, the total reported CFS volume for Address 2 only increased from two to three.

INTERSECTIONS

One final grouping of street-light enhancements was the analysis of three separate intersections that had NESCO lights installed. As with all the other target areas, a preinstallation and a postinstallation period was defined for each intersection, and an analysis of the raw counts of total CFS was performed. As noted below, each of the three intersections exhibited a decline in total CFS, although the extremely small number of incidents (only 23 CFS for all three intersections throughout a period encompassing 80 weeks) prevents any generalized conclusions about the deterrent effects of intersection lighting enhancements. (Because of the small number of CFS, no tables are used to present our findings on intersections.) All three intersections reduced total CFS after the NESCO street lights were installed. One dropped from five CFS to one, another from five CFS to two, and the third from six CFS to four CFS in the postinstallation period. These data provide some additional evidence that the NESCO lights may be associated with a drop in CFS, in particular at intersections.

ANALYSIS OF AVERAGE WEEKLY CALLS FOR SERVICE

Another way of searching for the effects of enhanced lighting is to examine changes in the average weekly CFS before and after the installation of street lights. The traditional way this is done is to test for a significant statistical difference between the preinstallation average weekly CFS and the postinstallation average weekly CFS. The F ratio can tell us whether the differences in mean CFS between the pre- and postinstallation periods is simply due to chance (i.e., part of the routine weekly variation of crime reporting) or instead due to a change that is greater than you would expect to see based on average weekly variation in CFS.

In reviewing these findings, two considerations should be kept in mind. First, these data reflect the actual changes in mean weekly CFS after street

lights are installed. These are real changes in the mean rate based on the universe of CFS for each area during the preinstallation and postinstallation periods. Second, the use of statistical testing such as the *F* ratio usually presupposes a random sample was used to generate the units of analysis and that users of the analysis wish to generalize to a broader population of units similar to the random sample. No such generalization can be made here because the target areas and the time series of data used for the analysis were not random and cannot be used as a basis for conclusions about the impact of street lights in other areas not examined in this study. The *F*-ratio results are reported here to give an idea about the relative magnitude of changes in the four main target areas only (Areas A, B, C, and D) rather than as a basis for drawing inferences about other lighting initiatives.

Average weekly CFS in the preinstallation period and postinstallation period are analyzed for Areas A (and A2), B, C (and C2), and D in two ways. First, all crime categories are grouped together to obtain one single weekly mean CFS, and we determine whether a significant statistical change occurred after street lights were installed. Following this, we examine whether changes in certain broad categories of CFS were associated with enhanced street lighting. To do this, total CFS is broken down into three categories: (a) violent (i.e., robberies, crimes against persons, and gun violations); (b) property (i.e., vandalism, burglary, and vehicular); and (c) miscellaneous (i.e., surveillance, accidents, disturbances, and traffic violations).

AREA A: CHANGES IN AVERAGE WEEKLY CFS

Area A received NESCO street light additions, whereas Control Area A2 did not. These two areas exhibit some difference in their mean weekly CFS for all crime categories, but no significant differences when CFS are examined in terms of three broad crime categories. Tables 7 and 8 report the findings for Area A and Control Area A2. In Area A, which had NESCO lights installed, average weekly CFS doubled, from 0.35 CFS before enhanced lighting to 0.72 after the installation of lights (see Table 7). This was a significant statistical change. Control Area A2 experienced a statistically insignificant decline from 0.69 to 0.55 weekly CFS. After NESCO lights were installed in Area A, all three broad categories of crime (violent, property, miscellaneous) increased, but all the changes were within the average weekly variation in CFS (see Table 8). There were no statistically significant changes. Control Area A2 experienced slight but statistically insignificant reductions in each category of CFS.

TABLE 7: Average Weekly Calls for Service

	Preinstallation	*Postinstallation*	*F Ratio*
Area A (NESCO lights)	.35	.72	4.43*
	(.55)	(.80)	
	n = 29	*n* = 29	
Area A2 (no NESCO lights)	.69	.55	.44
	(.76)	(.83)	*ns*
	n = 29	*n* = 29	
F ratio	3.90*	.65	
		ns	

NOTE: NESCO = Near Eastside Community Organization, Inc. Standard deviations in parentheses. *n* = number of weeks.
*Significant at .05 level.

AREA B: CHANGES IN AVERAGE WEEKLY CFS

Area B was also the target of additional NESCO street lights in the near eastside area. Table 9 indicates that mean weekly CFS in Area B declined from 1.14 before the street lighting enhancement to 0.83 after the installation of NESCO lights. Because of the routine variation in weekly CFS within Area B during the 58 weeks that were analyzed, this decrease was not statistically significant. Similarly, there were no statistically significant declines in the average weekly CFS for the three broad categories of crime, although both property and miscellaneous CFS exhibited absolute drops in weekly averages after NESCO lights were installed, as shown in Table 10. Property crime CFS declined by one half (0.28 CFS per week to 0.14 per week), and miscellaneous CFS such as disturbances dropped from 0.66 prior to installation to 0.45 afterwards. However, in considering these findings for Area B, it should be noted that Area B did exhibit a decline in its average CFS after street lights were installed, some of which could be attributed to improved lighting. In other words, a lack of statistical significance in this case does not necessarily mean street lights were not a factor in the reduction of average weekly CFS.

AREA C AND CONTROL AREA C2: CHANGES IN AVERAGE WEEKLY CFS

Area C (which received NESCO lights) and Control Area C2 (which did not) present evidence of a very different nature. The differences in their respective average weekly CFS are reported in Tables 11 and 12. In terms of av-

TABLE 8: Average Weekly Calls for Service—Area A

	Violent			*Property*			*Miscellaneous*		
	Preinstallation	*Postinstallation*	F *Ratio*	*Preinstallation*	*Postinstallation*	F *Ratio*	*Preinstallation*	*Postinstallation*	F *Ratio*
Area A	.03	.10	1.05	.00	.07	2.07	.31	.52	1.62
	(.19)	(.31)	*ns*	—	(.26)	*ns*	(.54)	(.69)	*ns*
	n = 29	*n* = 29		*n* = 29	*n* = 29		*n* = 29	*n* = 29	
Area A2	.14	.10	.12	0	0	—	.45	.31	.66
	(.44)	(.31)	(.73)	—	—	—	(.69)	(.60)	*ns*
	n = 29	*n* = 29					*n* = 29	*n* = 29	
F ratio	1.35	—		—	2.07		.72	1.48	
	ns				*ns*		*ns*	*ns*	

NOTE: Standard deviations are in parentheses. *n* = number of weeks.
*Significant at .05 level.

TABLE 9: Average Weekly Calls for Service—Area B

	Preinstallation	*Postinstallation*	F *Ratio*
Area B (NESCO lights)	1.14 (1.19) *n* = 29	.83 (1.10) *n* = 29	1.06 *ns*

NOTE: NESCO = Near Eastside Community Organization, Inc. Standard deviations are in parentheses. *n* = number of weeks.
*Significant at .05 level.

erage weekly CFS for all crime categories (shown in Table 11), both Area C and Control Area C2 experienced statistically significant increases when comparing the preinstallation to the postinstallation periods. Area C, with NESCO lights, increased its weekly average to 4.77 CFS up from 3.77 CFS in the preinstallation period. However, Control Area C2 also experienced a significant increase (0.98 to 1.81), so the increase in weekly rates was occurring both with and without improved street lighting.

But the increases did not occur in all categories of CFS. As noted in Table 12, the increase in average weekly CFS was largely a result of violent categories of crime. Both Area C and Control Area C2 exhibited substantial (although statistically insignificant) increases in violent categories. However, this category is not theoretically assumed to be affected by lighting. On the other hand, property crime, as measured by average weekly CFS, declined from 0.46 to 0.35 in Area C but only from 0.11 to 0.09 in Control Area C2. Similarly, the miscellaneous CFS category did not change at all in Area C after NESCO lights were installed, but Control Area C2 (with no added lighting) experienced a sizable (but statistically insignificant) increase from 0.62 to 0.93. Although none of these observed changes was statistically significant, the proportionally larger decline in Area C's weekly average CFS for property crimes and the stabilization of miscellaneous CFS (compared to the control area's increase) might conceivably be associated with the enhancements to street lighting provided by the NESCO initiatives.

AREA D: CHANGES IN AVERAGE WEEKLY CFS

From the preinstallation period to the postinstallation period, Area D demonstrated a slight decline in average weekly CFS, from 1.52 to 1.23 (shown in Table 13). The drop was not statistically significant, but as noted

TABLE 10: Average Weekly Calls for Service—Area B

	Violent			*Property*			*Miscellaneous*		
	Preinstallation	*Postinstallation*	F *Ratio*	*Preinstallation*	*Postinstallation*	F *Ratio*	*Preinstallation*	*Postinstallation*	F *Ratio*
Area B	.10	.10	—	.28	.14	1.67	.66	.45	.92
	(.31)	(.31)		(.45)	(.35)	*ns*	(.90)	(.74)	*ns*
	n = 29	*n* = 29		*n* = 29	*n* = 29		*n* = 29	*n* = 29	

NOTE: Standard deviations are in parentheses. *n* = number of weeks.
*Significant at .05 level.

TABLE 11: Average Weekly Calls for Service—Area C and Control Area C2

	Preinstallation	*Postinstallation*	F *Ratio*
Area C (NESCO lights)	3.77	4.77	3.75*
	(2.33)	(2.46)	
	$n = 43$	$n = 43$	
Area C2 (no NESCO lights)	.98	1.81	6.90*
	(1.21)	(1.71)	
	$n = 43$	$n = 43$	
F ratio	48.73*	41.88*	

NOTE: NESCO = Near Eastside Community Organization, Inc. Includes Indianapolis Police Department intervention dates. Standard deviations are in parentheses. n = number of weeks.
*Significant at .05 level.

above for other target areas, it represented an absolute decline in the weekly rate. In the context of the three broad categories of crime as shown in Table 14, Area D exhibited the same characteristics as Area C: CFS for violent crime increased, and average weekly CFS for property and miscellaneous crime decreased (absolutely but not statistically). Thus, evidence from Area D also suggests a possible link between improvements in street lighting and a decline in the weekly rate of CFS for nonviolent criminal activity.

CONCLUSION

The evaluation of selected street lighting initiatives in the NESCO area was designed to discern impacts, if any, that the installation of added street lighting has had on the number of crimes. The study measured crime in terms of calls for service (CFS) to the police. Two different approaches were used to assess the impact of lighting. The findings of both approaches are summarized in Table 15, which reports (a) whether the raw count of CFS increased or decreased from the pre- to the postinstallation period in the target and control areas, and (b) whether the average weekly CFS increased or decreased after the installation of the street lights in Areas A through D.

In the first approach, changes in the raw count (i.e., total CFS) of CFS before (pre) and after (post) the installation of additional lights were examined in each of the nine target areas that received lights and in the two control areas that did not. The findings of the raw count analysis were mixed, but even so, some potential impacts associated with enhanced lighting can be identified. Of the nine target areas that received NESCO lighting, six showed some evi-

TABLE 12: Average Weekly Calls for Service—Area C and Control Area C2

	Violent			*Property*			*Miscellaneous*		
	Preinstallation	*Postinstallation*	F *Ratio*	*Preinstallation*	*Postinstallation*	F *Ratio*	*Preinstallation*	*Postinstallation*	F *Ratio*
Area C	.53	.70	.89	.46	.35	.80	2.56	2.58	.00
	(.80)	(.80)	*ns*	(.59)	(.61)	(.37)	(1.99)	(1.78)	*ns*
	$n = 43$	$n = 43$		$n = 43$	$n = 43$		$n = 43$	$n = 43$	
Area C2	.07	.23	2.59	.11	.09	.12	.62	.93	1.52
	(.25)	(.61)	*ns*	(.32)	(.29)	(.73)	(.84)	(1.37)	*ns*
	$n = 43$	$n = 43$		$n = 43$	$n = 43$				
F ratio	13.25*	9.14*		11.49*	6.09*		34.21*	23.31*	

NOTE: This table includes Indianapolis Police Department intervention dates. Standard deviations are in parentheses; n = number of weeks.
*Significant at .05 level.

TABLE 13: Average Weekly Calls for Service—Area D

	Preinstallation	*Postinstallation*	F *Ratio*
Area D (NESCO lights)	1.52 (1.21) $n = 31$	1.23 (1.05) $n = 31$	1.02 *ns*

NOTE: NESCO = Near Eastside Community Organization, Inc. Standard deviations are in parentheses; n = number of weeks.
*Significant at .05 level.

dence of lower CFS volumes after lighting was installed. All three intersections examined showed a reduction in CFS after street lights were installed. One of the two multiaddress groupings showed a reduction in CFS volume. Results were very mixed, however, for the two multiblock areas that were compared against control areas that did not obtain NESCO lights. In one target area/control area group, CFS volume in the better illuminated neighborhood increased, whereas CFS volume in the control area decreased, which of course, is counter to expectations. The other target area/control area grouping reflected high CFS volumes both before and after street lights had been installed in the target area.

The second approach was a comparative analysis of the mean weekly CFS in the preinstallation and postinstallation periods. If lighting had a deterrent effect, we would expect to see evidence of lower CFS volumes as measured by the average weekly CFS after lights were installed. In our analysis, this was done for the four multiblock areas that received lights and the two control areas that received no lights. These findings, too, are mixed, but there is some evidence that street lights are associated with reductions in CFS volume. Two NESCO-lighted areas had a lower mean weekly CFS after installation than before, which is consistent with expectations about the impact of lights. One target area/control area was contrary to expectations: Average weekly CFS increased postinstallation in the lighted area but decreased in the less illuminated control area. However, with regard to this area, the more illuminated target area experienced a greater reduction in average CFS for property and miscellaneous crime than did the control area. Although none of these differences were statistically significant changes, they are nonetheless suggestive of the expected deterrent influence of enhanced street lighting.

Overall, the findings of this study are consistent with the mixed reports of other previous work on the deterrent potential of lighting. The analysis of the target areas suggests that enhanced street lighting in particular neighborhoods is sometimes associated with concurrent reductions in reported crime.

TABLE 14: Average Weekly Calls for Service—Area D

	Violent			*Property*			*Miscellaneous*		
	Preinstallation	*Postinstallation*	F *Ratio*	*Preinstallation*	*Postinstallation*	F *Ratio*	*Preinstallation*	*Postinstallation*	F *Ratio*
Area D	.16	.32	1.87	.35	.16	2.62	.94	.65	1.54
	(.37)	(.54)	*ns*	(.55)	(.38)	*ns*	(1.03)	(.80)	*ns*
	$n = 31$	$n = 31$		$n = 31$	$n = 31$		$n = 31$	$n = 31$	

NOTE: Standard deviations are in parentheses; n = number of weeks.
*Significant at .05 level.

TABLE 15: Summary of Findings

	Analysis of Raw Counts of CFS		*Analysis of Average Weekly CFS*	
Area	*Increased*	*Decreased*	*Increased*	*Decreased*
A	•			
A2		•		•
B		•		•
C	•	• (excluding traffic, guns)	•	• (property, miscellaneous)
C2	•		•	
D		•		•
Address 1		•		
Address 2	•			
Intersection 1		•		
Intersection 2		•		
Intersection 3		•		

NOTE: CFS = calls for police service.

It is possible that many street lights have a real deterrent effect on the individual address, but the diffusion of positive deterrent effects to other adjacent or nearby parcels may be very limited. This is suggested by the findings that the most clear-cut decline in CFS occurred at intersections (all three that were analyzed), less clear-cut when examining groupings of different addresses receiving lights (one of the two groups analyzed), and extremely mixed when a group of addresses both with and without new street lights are analyzed together (neither of the two multiblock target areas showed clear decreases).

Although we believe this to be a vigorous scientific assessment of the impact of lighting on crime to date, disentangling the potential effects of neighborhood social disorganization, police initiatives, and victim/offender behavior patterns separate from the impact of lighting is beyond the scope of this work and potentially all work in the area of physical environment and crime. This study did not examine the extent to which fear of crime may have been reduced or pedestrian traffic increased by the use of street lights. In addition, all future work should consider the possibility of contextual effects (e.g., poor lighting may not have the same effect in all areas).

APPENDIX
Delineation of Crime Complaint Categories

Miscellaneous/Surveillance
- 212—PERSON DRUNK
- 214—PERSON EXPOSING
- 234—PROWLER
- 250—VEH SUSPICIOUS
- 251—SUSPICIOUS VEH
- 268—PERSON SUSPICIOUS
- 286—TREPASS
- DIS—ALL KIND

Robbery
- 112—HOLDUP-PROG
- 236—PURSE GRAB
- 238—ROBBERY-BUSN
- 240—ROBBERY-PERSON
- 241—ROBBERY-PERSON-PROG
- 264—ROBBERY-BUSN-PROG
- 265—ROBBERY-PROG
- 280—ROBBERY-RES
- 282—ROBBERY-RES-PROG

Person
- 120—PERSON-SHOT
- 121—PERSON-BATTERED
- 122—PERSON-STABBED
- 128—RAPE-REPORT
- 129—RAPE-ATT
- 200—ASSAULTED/BATTERED
- 201—PERSON-ASSAULTED
- 262—PERSON-BEATEN-PROG
- 616—ACCIDENT-PI-PRIVATE PROPERTY

Traffic
- 252—TRAFFIC STOP
- 266—TRAFFIC ARREST
- 548—DIRECT TRAFFIC
- 561—TRAFFIC ARREST
- 562—TRAFFIC HAZARD
- 563—DIRECT TRAFFIC
- 564—WRECKER

Vandalism
- 136—VANDALISM-PROG
- 233—DAMAGE TO PROPERTY
- 256—VANDALISM
- 618—DAMAGE TO PROPERTY

Burglary
- 104—BURGLARY-PROG
- 202—BURGLARY-BUSN
- 204—BURGLARY-GARAGE
- 206—BURGLARY-RESID
- 207—BURGLARY-ATT
- 270—BURGLARY-OTHER

Vehicular
- 132—VEH STRIPPING
- 138—VEH THEFT-PROG
- 224—VEH LARCENY
- 248—VEH STRIPPED
- 292—VEH THEFT-ATT

Gun
- 124—PERSON W/GUN
- 130—SHOTS FIRED
- 142—PERSON W/WEAPON

Accidental
- 600—ACCIDENT-NO INFORMATION
- 602—ACCIDENT-PD
- 604—ACCIDENT-PD-CITY PROPERTY
- 606—ACCIDENT-PD-HITRUN
- 608—ACCIDENT-PI
- 610—ACCIDENT-PI-CITY PROPERTY
- 612—ACCIDENT-PI-HITRUN
- 614—ACCIDENT-POSSIBLY FATAL

Disturbance
- 400—DISTURBANCE
- 402—DISTURBANCE/DOM
- 404—DISTURBANCE/WEAPON
- 514—CHECK PREMISES
- 546—SUBJECT STOP

Drugs
- 228—NARC INV
- NARC

NOTE: PROG = in progress; VEH = vehicle; BUSN = business; RES = residence; ATT = attempted; PD = property damage; PI = personal injury; DOM = domestic; NARC = narcotics.

NOTES

1. In Areas C, C2, and D, street lights located on the outer portion of study area boundaries were included. We assumed that persons residing in the inner portion of these study area boundaries would be affected by street lights located across the street. The total number of lights in each study area does not include non-NESCO lights in alleyways.

2. For each complaint, IPD's database includes complaint type, patrol car number, number of patrol cars at scene, number of minutes at scene, address and street at which the complaint occurred, date of complaint, time of arrival, time of departure, beat number, quadrant, north-south and east-west geographical coordinates of complaint location, complaint number, complaint description, and whether a report was filed (yes or no).

REFERENCES

Atkins, S., S. Husain, and A. Storey. 1991. *The influence of street lighting on crime and fear of crime* (Home Office Crime Prevention Unit Paper No. 28). London: Home Office.

City of Atlanta. 1975. *Street lighting project: Final evaluation report.* Washington, DC: National Criminal Justice Reference Service.

Brooks, L. W., A. Piquero, and J. Cronin. 1994. Work-load rites and police officer attitudes: An examination of busy and slow precincts. *Journal of Criminal Justice* 22 (3): 277-86.

Challinger, D. 1991. Less telephone: How does it happen? *Security Journal* 2:11-119.

Cohn, E. G. 1993. The prediction of police calls for service: The influence of weather and temporal variables on rape and domestic violence. *Environmental Psychology* 13:71-83.

Ditton, J., and G. Nair. 1994. Throwing light on crime: A case study of the relationship between street lighting and crime prevention. *Security Journal* 5 (3): 125-32.

Evans, D. J., N. R. Fyfe, and D. T. Herbert. 1992. *Crime, policing and place: Essays in environmental criminology.* New York: Routledge, Chapman and Hall.

Griswold, D. B. 1984. Crime prevention and commercial burglary: A time series analysis. *Journal of Justice* 12:493-501.

Kaplan, H. M., L. H. Palkovitz, and E. J. Pesce. 1978. *Crime prevention through environmental design. Final report on commercial demonstration.* Arlington, VA: Westinghouse Electric.

Kessler, D. A., and S. Duncan. 1996. The impact of community policing in four Houston neighborhoods. *Evaluation Review* 20 (6): 627-69.

Nair, G., J. Ditton, and S. Phillips. 1993. Environmental improvements and the fear of crime: The sad case of the "pond" in Glasgow. *British Journal of Criminology* 33 (4): 555-61.

Painter, K. June 6, 1990. Women's experience and fear of crime and the scope for public lighting as a means of crime prevention. Paper presented to the Leeds City Conference on Crime and Lighting, Leeds, England.

———. 1994. The impact of street lighting on crime, fear, and pedestrian street use. *Security Journal* 5 (3): 116-24.

Painter, K., and D. P. Farrington. 1997. The crime reducing effect of improved street lighting: The Dudley project. In *Situational crime prevention: Successful case studies.* 2nd ed. Edited by R. V. Clarke, 209-26. Guilderland, NY: Clarke Harrow and Heston.

Poyner, B. 1981. Crime prevention and the environment: Street attacks in city centers. *Police Research Bulletin* 37:10-18.

Poyner, B., and B. Webb. 1987. *Successful crime prevention: Case studies*. London: Tavistock Institute of Human Relations.

Reiss, A., Jr. 1971. *The police and the public*. New Haven, CT: Yale University Press.

Reppetto, T. A. 1974. *Residential crime*. Cambridge, MA: Ballinger.

Siegel, L. J. 1995. *Criminology: Theories, patterns, and typologies*. 5th ed. New York: West.

Thurman, Q. C., A. L. Giacomazzi, and M. D. Reisig. 1996. Community-based gang prevention and intervention: An evaluation of the neutral zone. *Crime and Delinquency* 42 (2): 279-95.

Tien, J. M., V. F. O'Donnell, A. Barnet, A. Mirchandani, and B. Pitu. 1977. *Street lighting projects: National evaluation program, Phase I summary report*. Washington, DC: National Institute of Law Enforcement and Criminal Justice.

Vrij, A., and W. Winkel. 1991. Characteristics of the built environment and fear of Crime: A research note on interventions in unsafe locations. *Deviant Behavior: An Interdisciplinary Journal* 12:203-15.

Weisburd, D., and L. Green. 1995. Policing drug hot spots: The Jersey City drub market analysis experiment. *Justice Quarterly* 12 (4): 711-35.

Wright, R. and M. Heilweil. 1974. *The impact of street lighting on crime*. Ann Arbor: University of Michigan.

Kenna Davis Quinet is an assistant professor of criminal justice in the School of Public and Environmental Affairs at Indiana University, Indianapolis. Her research interests include policing, victimization, and homicide. She has worked extensively with the Indianapolis Police Department implementing and evaluating community policing.

Samuel Nunn is an associate professor of urban planning and management and associate director of the Center for Urban Policy and the Environment in the School of Public and Environmental Affairs at Indiana University, Indianapolis. His research interests include the uses of information technologies in urban public services and economic development.