MEASUREMENT TECHNIQUES USEFUL IN EVALUATING THE EFFECTIVENESS OF PROGRAMS FOR PREVENTING AND CONTROLLING DELINQUENCY

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Juvenile delinquency like many other behavior based problems is extremely difficult to measure unless delinquency is defined narrowly in terms of officially ajudicated violations of laws or ordinances. Many studies have shown that only a small proportion of offensive, law violating behavior results in arrests and only a portion of the arrests results in recorded cases of juvenile delinquency.*

The measurement of juvenile delinquency can be regarded as an end in itself or as one of several aspects of preventing and controlling this social problem. In this paper the focus is on measurement techniques useful in evaluating programs of prevention and control.

There are at least three levels of sophistication in the use of delinquency measurements in relation to prevention and control. At the first level, counts of referrals to the juvenile court, officially ajudicated delinquency cases or police arrests of juveniles are commonly used to sound the alarm or document the success of various programs. Even though such data are usually converted to ratios based on the estimated population at risk, there is little attention given to problems such as random variation in rates and the effects of changes in the age, sex, race, and socio-economic composition of the population. Editorial writers, civic leaders, and administrators of agencies are inclined to make uncritical uses of delinquency rates. Actions taken on the basis of questionable data may entail the passage of new laws, enlargement of budgets and staff or tightening up on law enforcement. The net effect of such actions may be a further increase in the reported delinquency cases as a result of the new laws, more policemen to make arrests, and a larger ratio of apprehensions.

At a second level, the reports on individual juvenile delinquency cases are coded according to the census tract of the delinquent's residence. Tabulations of such data by sex, race, and census tract converted into rates provide a measure of the comparative incidence of reported delinquency cases in different types of neighborhoods. Through correlation analysis based on indices of the social and economic characteristics of census tracts, it is possible to identify variables associated with the apprehended and reported delinquency. Regression analysis can be employed to make predictions of delinquency rates for comparison with the actual rates. The selection of sites for demonstration programs to prevent and control delinquency may be improved through access to such data. Later in this paper an illustrative use of regression analysis techniques will be described in relation to data for Washington, D. C.

At the third level, a variety of carefully tailored measurement techniques is sometimes used in evaluating the effectiveness of neighborhood based delinquency control programs. Changes in the measurements taken before and after conducting action projects facilitate drawing conclusions concerning the extent to which objectives are achieved. Measurements are also needed in control areas to determine the extent to which changes can be credited to the planned actions.

Although sound measurement techniques are commonly used in fields such as biological and agricultural experimentation they are not widely used in research to solve social problems such as juvenile delinquency. However, there is a small trend developing towards a greater use of such methods as indicated by the demonstration projects to prevent and control delinquency under development in a number of large cities through financing from the President's Committee on Juvenile Delinquency and Youth Crime. Criteria used by the Review Panel in making grants include adequate plans for systematic evaluation as well as explication of a well conceived theoretical framework to provide a basis for the planned actions.

Community programs directed towards preventing and controlling delinquency are tending towards a comprehensive approach involving many of the major institutions such as school systems, welfare departments, recreation agencies, employment offices and places of employment as well as the correctional agencies. Programs conducted in school systems include vocational education, special classes, counselling, sheltered employment experience, and cultural

* James F. Short and F. Ivan Nye, "Extent of Unrecorded Juvenile Delinquency: Tentative Conclusions," the Journal of Criminal Law, Criminology and Police Science Vol. 49, Nov.-Dec., 1958 296-302.

enrichment. Public welfare departments may use reduced case loads with specialized workers to provide services for delinquent prone children in families receiving public assistance, group counselling for parents of delinquent youth, and work relief programs. Recreation departments may provide specially trained workers who are assigned to work with delinquent gangs, after-school recreation programs, and leisure activities to meet the need for adventure and excitement as well as new experience and relaxation. Correctional institutions test various levels of group as well as individual counselling.

Theorectical assumptions underlying the design of programs may be broadly classified into those which stress the personality and psychological attributes of individual youth as causative factors and those which stress social systems such as friendship groups, neighborhoods and subcultures. Variants of these theories stress the importance of effective social controls. Some programs reflect a major emphasis upon the family as an influential and continuing social system determining much of individual behavior. Since many factors separately and jointly produce delinquency, each brand of theory tends to find some justification. However, the galaxy of theories and programs complicates evaluation and is confusing to citizen leaders.

Evaluation techniques need to draw upon experience from many fields in the use of experimental designs and related statistical theory. The target population towards which the action is directed needs to be carefully defined as well as the environmental setting in which the action takes place. Furthermore, the exact nature of the action must be specified. The kind and amount of change attributable to the actions should be measured as well as the unexpected negative effects. It is desirable to have an assessment of the likely long term effects of the program. From a broader policy standpoint it is essential to know the costs of the program as well as the investment of volunteer effort. A more subjective but obviously significant criterion of success relates to the effect of the project in convincing leaders of the necessity for allocating more resources to carry on continued research and experimentation.

Measurement techniques may be broadly classified as to whether they are directed towards assessing the "net impact" or total effect of a whole set of programs or whether they are directed towards determining the effect of specific programs. They may also be grouped according to whether the data are used primarily as aggregations for small areas such as census tracts or primarily in relation to specific individuals.

Measurement data may also be grouped according to source and method of collection. On the one hand official or semi-official data are collected by police, court and treatment agencies. For the most part these data have not been standardized although the Children's Bureau and the Federal Bureau of Investigation have made progress in this direction. Since the official reports do not reflect the bulk of delinquent behavior, other measurement techniques are being explored. The "self-report" method entails the use of group administered questionnaires listing major classifications of delinquent acts in relation to which youth are asked to report the degree of their own participation. These questionnaires are usually administered without signatures so as to encourage accurate reporting. Experience indicates that where great care and skill is exercised in administering such questionnaires, quite plausible data can be obtained. However, most of the studies using this method have been conducted in smaller cities.

Judgements concerning the volume of offensive behavior occurring in specific neighborhoods have been sought from residents, business men, and community service workers. Interviewees may also be asked to nominate specific youth presenting serious behavior problems. The effectiveness of this method obviously depends upon the extent to which informants are intimately acquainted with the neighborhood situation and the youth population.

A most promising measurement technique entails the use of a semi-projective questionnaire which can be administered to youth assembled in groups. One such instrument, the Jessness Inventory, has been used to differentiate the delinquents from the non-delinquents in school populations. It is claimed that this instrument has been able to identify correctly about 85 percent of the delinquents and about the same proportion of the non-delinquents in a particular school where fairly accurate information was available on delinquency from other sources.

The measurement of the specific effects of individual programs within a large set of programs entails the use of somewhat different measurement techniques. One approach is to use specially designed interview or questionnaire methods directed towards participants and non-participants in the specific program. Adults intimately acquainted

with the individual youth may also be interviewed to obtain judgements concerning the effects. Programs may be carefully observed by trained personnel to identify features with positive and negative impacts. Case records on individuals may be analyzed in depth to obtain reflections of the changes attributable to particular programs.

An interesting use of statistical techniques in evaluating the results of programs of prevention and control is illustrated by the work done in the District of Columbia to appraise the selection of census tracts in which demonstration programs are to be conducted. Through the use of many statistical and operational criteria, 18 contiguous census tracts were selected by Washington Action for Youth* to constitute a "target area" in which to locate a set of action programs to prevent and control delinquency. One of the major criteria for evaluating the net effect of the action programs is assumed to be the change in the percentage of youth in each census tract referred to the Juvenile Court. If analysis should indicate that at the beginning of the project the 18 census tracts had delinquency rates considerably above prediction, the probability would be high that many of the census tracts would exhibit a reduced delinquency rate after a year or two even though no action programs were conducted. Such a trend is to be expected through the operation of the "regression toward the mean" principal. Many studies have found that extreme deviates from a mean position tend to change by regressing towards the mean without any assignable cause for such change. Accepting this principle it is important to determine how census tracts in a demonstration or target area are distributed with respect to the ratio between the actual and predicted delinquency rate at the starting and termination dates. If the tracts are approximately randomly distributed with respect to the ratio between the actual and predicted rate at the starting date and change in the direction of a lower ratio at the termination date, it could be concluded that the action program was effective. Statistical analysis could be used to determine the degree of significance to be accorded the observed change.

However, before conclusions can be drawn it would be necessary to obtain answers to questions such as the following:

1. Was there any change in the procedures or criteria used in reporting offensive behavior in the target area, which could explain the observed changes in rates?
2. Was there an unusual change in the make-up of the population at risk sufficient to account for the observed changes?
3. Did unplanned events or actions take place within the target area between the starting and termination dates which could influence delinquency rates to a greater extent in the target area than in the rest of the city?

Personnel responsible for the final evaluation would need to keep such questions in mind in planning their research.

The study to be described was concerned only with the development of procedures for predicting delinquency rates within the target areas on the basis of the relationships prevailing among census tracts throughout the city between the delinquency referral rate and an efficient set of predictors. It was hoped that the identification of patterns in the District of Columbia might be useful in selecting predictors in other cities.

The first step was to obtain a census tract tabulation of delinquency referrals to the D.C. Juvenile Court during a three year period (July 1, 1959 to June 30, 1962). Data were sought for three years rather than for one year so as to reduce the random error in rates which results when rates are based on too small a population. The analysis was restricted to the male delinquents so as to have a more homogeneous population than if female delinquents were included, with rates amounting to less than one-fifth of the rates for the males. The male delinquency referrals were divided into two groups: (1) a white group comprising 14.4 percent of the male delinquency referrals; (30.7 per cent of the population 10 to 17 years of age in the D. of C. was white in 1960) (2) a nonwhite group comprising 85.6 percent of the male delinquency referrals; (69.3 percent of the population 10 to 17 was nonwhite). This resulted in a rate of 8.5 white male referrals to the Juvenile Court during the three year period per 100 white boys 10 to 17 years of age in 1960, as contrasted with a corresponding rate of 22.3 for the nonwhites.

Because of the sizeable differences

* This is the Washington, D.C. organization financed largely by the President's Committee on Juvenile Delinquency and Youth Crime.

in delinquency referral rates between the white and nonwhite males it was decided to conduct the regression analysis in two parts:

Part A: using data on referrals of white male delinquents and independent variables based on the white population.
Part B: using data on referrals of nonwhite male delinquents and independent variables based on the nonwhite population.

Accordingly, ratios were computed for the white and nonwhite segments of each census tract for each of the 15 independent variables shown in Table 1. The 15 variables are arrayed according to the average correlation coefficient between each variable and the male delinquency referral rate. Ranks are shown for the variables in each of the two groups on the basis of the correlation between the independent variables and the delinquency referral rate. The last column shows the difference in ranks between the white and nonwhite segments. The coefficient of rank correlation between the ranking of the coefficients based on the white and nonwhite segments was only .294. This indicates that there is only slight similarity between the pattern of relationship with the independent variables in the white and nonwhite segments. It will be noticed, however, that for six of the 15 variables there was a correlation of .55 or higher with juvenile delinquency for both the white and nonwhite segments. Three of these six variables ranked higher among the white segments and two among the nonwhite. It so happened that these six variables were eventually selected as the predictors in the final multiple regression equations.

Through the use of facilities at the National Bureau of Standards it was possible to explore the effect of special combinations of items as well as the effect of editing the data. With an Omnitab program developed for use on the IBM 7090 computer, the following output for a particular set of variables was obtained in about three minutes of machine time:

1. Computation of the regression coefficients, standard error of estimate and many additional statistical measures.
2. Calculation of squared residuals from which the multiple correlation coefficient was easily derived.
3. Plotting of scatter diagrams showing the distribution of the census tracts according to delinquency rate and each of the independent variables.
4. Computation of the predicted delinquency rate based upon the regression equation as well as the difference between the actual and predicted rates for each census tract segment.
5. The above operations carried out separately for the white and nonwhite segments of the census tracts.

By slight changes in the parameter cards the order and combination of the independent variables were easily changed. Furthermore, editing was accomplished by simply removing the appropriate census tract cards.

The first run using all 69 white census tract segments and all 82 nonwhite segments with all 15 independent variables produced a multiple correlation coefficient of .821 for the white segments and .809 for the nonwhite segments. However, the standard error of estimate for the nonwhite segments was much too high (11.53) as contrasted with the comparable figure for the white segments (5.50). Examining the scatter diagrams a peculiar pattern was observed for the nonwhite segments with ratios above 40. This pattern is illustrated in Figure 1-B with the bulk of the nonwhite tracts distributed similarly to the white segments in a relatively smooth regression pattern. On the other hand, the nonwhite segments which had rates above 40 seemed to be responding to a special set of forces with little relationship to the independent variables. Examination of the scatter diagrams for the other 14 variables showed that a similar condition prevailed in all but three of the diagrams. Accordingly, it was decided to separate the 16 nonwhite segments exhibiting the unusual tendency and analyze them separately as will be described later.

Other editing rules were developed for the isolation of 20 white segments and four additional nonwhite segments. Most of these segments were isolated because they had too small a population of boys 10 to 17 (under 60). It was believed that random variation was introducing "noise" attributable largely to the small population in each of these segments. Another criterion for excluding several census tract segments was residence in group quarters by more than 20 percent of the total population in the census tract. It was reasoned that the inclusion of areas with a large proportion of the population living in

Table 1

ZERO ORDER CORRELATION COEFFICIENTS BETWEEN THE MALE DELINQUENCY REFERRAL RATE* AND EACH OF 15 INDEPENDENT VARIABLES FOR WHITE AND NONWHITE SEGMENTS OF CENSUS TRACTS

Independent variables derived from census tract data published by the Census Bureau	Variable no.	Correlation with male delinquency referral rate		Rank of correlatio coefficient		
		White	Nonwhite	White	Nonwhite	Diff
% of employed males in white collar or skilled jobs	5	-.733#	-.725	2	2	0
% of families with income over $5000 in 1959	4	-.747#	-.621#	1	6	-5
Separated, widowed or divorced males as % of ever married males	8	.714#	.629#	3	4	-1
% of population 25 & over with 12 or more years of school	3	-.588#	-.695#	8	3	5
Index of overcrowding**	7	.679#	.558#	4	9	-5
% of employed females in white collar or skilled jobs	6	-.473	-.726#	11	1	10
% of children under 18 living with both parents	2	-.552#	-.628#	9	5	4
% of male labor force unemployed	10	.667	.473	5	11	-6
% of housing units owner occupied	13	-.494	-.605#	10	7	3
Separated, widowed or divorced females as % of ever married females	9	.380#	.602#	12	8	4
% of males 10 to 17 nonwhite	15	.662	.209	6	14	-8
One person households as a % of all households	14	.334#	.521#	13	10	3
% of total population nonwhite	16	.592#	.247	7	13	-6
% of females 14 and over in the labor force	11	.062	-.313	15	12	3
Population in households per household	12	-.212	-.035	14	15	-1

* Male referrals to the D.C. Juvenile Court between July 1, 1959 and June 30, 1962 as a percent of males 10 to 17 years of age according to the 1960 U.S. Census.

** Computed by Metropolitan Population Project by adding percent of occupied housing units with 1.01 to 1.50 persons per room to three times the percent with 1.51 or more persons per room.

\# Variables included in the second set of computer runs to develop and make the predictions.

Figure 1-A

WHITE SEGMENTS OF CENSUS TRACTS PLOTTED ACCORDING TO WHITE MALE DELINQUENCY RATE AND ACCORDING TO PERCENT OF WHITE MALES IN WHITE COLLAR OR SKILLED JOBS

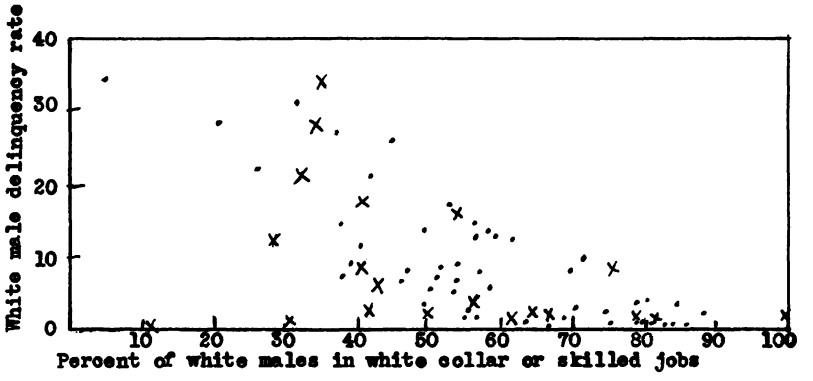

Figure 1-B

NONWHITE SEGMENTS OF CENSUS TRACTS PLOTTED ACCORDING TO NONWHITE MALE DELINQUENCY RATE AND ACCORDING TO PERCENT OF NONWHITE MALES IN WHITE COLLAR OR SKILLED EMPLOYMENT

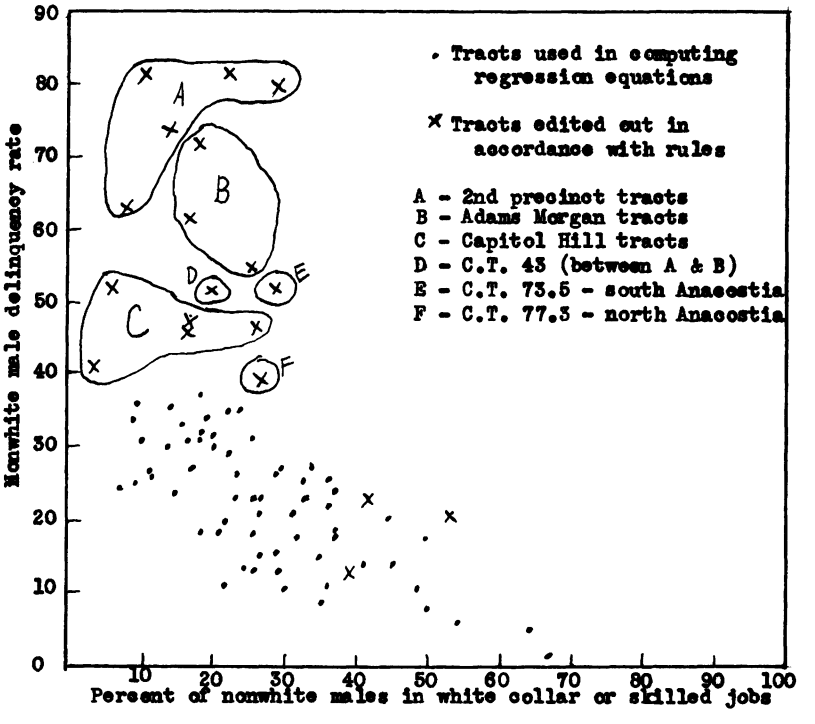

Table 2-A

INTERCORRELATIONS BETWEEN NINE INDEPENDENT VARIABLES USED IN COMPUTING THE MULTIPLE REGRESSION EQUATION FOR PREDICTING DELINQUENCY RATES IN WHITE SEGMENTS OF CENSUS TRACTS IN D.C.

Independent variable*	Var. no.	.707	Variable number							
		3	4	5	7	16	14	8	9	2
Over 12 yrs. of schooling	3	1.000	.768	.913	-.689	-.588	.253	-.323	.086	.372
Over $5000 income	4	.768	1.000	.862	-.803	-.562	.135	-.557	-.207	.572
Males in white collar jobs	5	.913	.862	1.000	-.762	-.634	.032	-.454	-.098	.492
Overcrowding index	7	-.689	-.803	-.762	1.000	.484	.003	.430	.020	-.366
% of population nonwhite	16	-.588	-.562	-.634	.484	1.000	.096	.562	.330	-.477
One person households	14	.253	-.135	.032	.003	.096	1.000	.694	.896	-.537
Separated, wid. & div. males	8	-.323	-.557	-.454	.430	-.562	.694	1.000	.783	-.721
Separated, wid. & div. females	9	.086	-.207	-.098	.020	.330	.896	.783	1.000	-.675
Children with both parents	2	.372	.572	.492	-.366	-.477	.537	-.721	-.675	1.000
		.293								.718

Table 2-B

INTERCORRELATIONS BETWEEN TEN INDEPENDENT VARIABLES USED IN COMPUTING THE MULTIPLE REGRESSION EQUATION FOR PREDICTING DELINQUENCY RATES IN NONWHITE SEGMENTS OF CENSUS TRACTS IN D.C.

Independent variable*	Var. no.	.844	Variable number								
		3	4	5	6	7	13	14	8	9	2
Over 12 yrs. of schooling	3	1.000	.861	.944	.932	-.849	.829	-.411	-.632	-.577	.636
Over $5000 income	4	.861	1.000	.816	.852	-.789	.911	-.441	-.492	-.505	-.585
Males in white collar jobs	5	.944	.816	1.000	.932	-.820	.794	-.439	-.631	-.571	.654
Females in white collar jobs	6	.932	.852	.932	1.000	-.797	.812	-.478	-.673	-.621	.638
Overcrowding index	7	-.849	-.789	-.820	-.797	1.000	-.723	.261	.416	.358	-.493
Percent of homes owned	13	.829	.911	.794	.812	-.723	1.000	-.585	-.558	-.587	.649
One person households	14	-.411	-.441	-.439	-.478	.261	-.585	1.000	.791	.739	-.631
Separated, wid. & div. males	8	-.632	-.492	-.631	-.673	.416	-.558	.791	1.000	.914	-.772
Separated, wid. & div. females	9	-.577	-.505	-.571	-.621	.358	-.587	.739	.914	1.000	-.795
Children with both parents	2	.636	.585	.654	.638	-.493	.649	-.631	-.772	-.795	1.000
		.537									.774

jails, army barracks, college dormitories, etc. would produce irrelevant variation. The position of these excluded areas with respect to delinquency and percent in white collar or skilled jobs is shown by crosses instead of dots in Figures 1-A and 1-B.

Simultaneously with the separation of the deviant areas as described above, the number of independent variables was reduced from 15 to 9 for the white segments and from 15 to 10 for the nonwhite segments. The variables to be included were selected largely on the basis of the data shown in Table 1. In this table the identity of the specific variables included in this run is shown by the number symbol (#) following the correlation coefficient. The multiple correlation coefficients obtained from this run were as follows:

White segments:	.874
Nonwhite segments:	.784

The most important gain noted in this run was the reduction of the standard error of estimate from 11.53 for the nonwhite segments down to 5.95. There was also a reduction in the standard error of estimate for the white segments from 5.50 down to 4.35.

To identify constellations of highly intercorrelated items with comparatively low correlations within constellations, a correlation matrix was prepared as shown in Tables 2-A and 2-B. Only those variables are included in this table with a reasonably high correlation with the delinquency referral rate. The columns and rows in this matrix were rearranged by trial and error until the illustrated pattern was achieved showing two constellations of items. The major constellation in the upper left quadrant of each table revealed a high intercorrelation between the socio-economic variables (.707 for the white segments and .844 for the nonwhite). A second constellation shown in the lower right quadrant presents high intercorrelations between family structure items (.718 for white segments and .774 for nonwhite). However, it was found that the average correlation between the variables in these two constellations was considerably less (.293 for the white segments and .537 for the nonwhite). The decision suggested by this analysis was the selection of four variables from the socio-economic items and two from the family structure items to make up a final predictive equation. Accordingly, a run based on variables number 2, 3, 4, 5, 7, and 8 for both the white and nonwhite segments produced the following multiple regression coefficients and standard errors of estimate:

	Multiple regress. coeff.	Stand. error of est.
White segments	.865	4.29
Nonwhite segments	.766	5.92

It will be noted that the coefficients were nearly as high as those obtained through using a much larger number of variables (nine for the white segments and ten for the nonwhite).

A supplementary regression analysis was conducted using the 16 nonwhite segments which were separated because they showed extremely deviant patterns in the scatter diagram as illustrated in Figure 1-B. A composite socio-economic index and a composite family structural index was developed manually for each of the 16 segments. This index was computed by summing the ranks of the 16 census tract segments in the six variables predictive of socio-economic status. The index of family structure was similarly computed using the four variables predictive of family structure. A regression analysis using these two indexes as independent variables produced a multiple correlation coefficient of .5805 and a standard error of estimate of 12.8. This was judged to be close to the threshold of significance at the .05 level.

It will be recalled that a major purpose for the multiple regression analysis was to appraise the selection of census tracts included in the target area for the demonstration project. When the 17 nonwhite and three white census tract segments included in the target area were classified according to the actual delinquency rate as a percentage of the predicted rate, a reasonably normal distribution was found as shown below:

Observed delinquency rate as percent of actual rate	Number of census tract segments
140 and over	1
130 to 139	2
120 to 129	4
110 to 119	3
110 and over	10
100 to 109	3
90 to 99	4
80 to 89	1
70 to 79	2
70 to 109	10

Even though the distribution seems to be centered at 110 rather than 100 it is quite likely that the scatter is sufficiently random to conclude that the selected census tracts meet the test. However, it should be noted that only three of the 20 segments were white so that the demonstration project located in this area would have to be focussed largely on the nonwhite delinquents.

One of the issues which frequently arises in the discussion of delinquency in cities with racially mixed populations concerns the explanation of the sizeable differences found in the rates for white and nonwhite neighborhoods. A commonly given explanation is that differences in socio-economic conditions and family structures in the white and nonwhite neighborhoods account for the observed differences. A test of this explanation is provided by a special regression run involving the 19 census tracts which had both white and nonwhite segments. Two regression equations were derived: one for the white segments of the 19 census tracts and another for the nonwhite segments of these tracts.* Among the 19 census tracts was one (C.T. 95.2) which had almost the same delinquency rate for the white and nonwhite segments (8.0 and 7.6) as well as similar socio-economic characteristics. However, when the equation based on the white segments was used to predict the delinquency rate for this tract using data for the white segment of census tract 95.2 as the input, a prediction was obtained of only 4.5 or about 56 percent of the actual rate. When the same data were used as input for the nonwhite equation, the predicted rate increased to 10.3. Similarly, when the nonwhite equation was used to predict the delinquency rate using the data for the nonwhite segment of census tract 95.2, the predicted rate was 12.5 or 64 percent higher than the actual rate. The white equation using the data for the nonwhite segment produced a rate of 4.1 or 54 percent of the actual rate. These findings suggest that there are undefined factors operating in nonwhite and white areas which produce higher delinquency rates in the nonwhite than in the white population even though they may have nearly identical socio-economic and family structural characteristics.

It is possible that special studies will be conducted in conjunction with the Washington Action for Youth demonstration project to identify the factors explaining the extremely high nonwhite male delinquency referral rates in 16 census tracts in the District of Columbia as well as the factors beyond those measured by available census indicators which result in higher delinquency rates among nonwhite than white youth. Without definitive research we can only speculate concerning the explanation of these phenomena.

In summary, a number of measurement techniques have been outlined for evaluating delinquency prevention and control projects. An exploratory project has been described involving the use of multiple regression techniques to make predictions concerning delinquency rates in specific census tracts. From these forecasts, ratios of actual to predicted delinquency rates were computed and used to assess the selection of census tracts included in the target area for a demonstration project within the District of Columbia. This assessment indicated that there was an acceptable distribution of census tracts in the selected area with respect to the ratio between the actual and predicted rates.

There is a large need for the extionsion of sound measurement techniques to the evlauation of a wide range of action programs purporting to demonstrate effectiveness in solving a variety of social problems. There is an important application of statistical theory and method in such endeavors.

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* The two regression equations were as follows:

White delinquency rate:

$$X_1 = 19.76 + .01439X_2 - .01134X_3 - .02978X_4 - .00781X_5 + .01927X_7 + .05363X_8$$

Nonwhite delinquency rate:

$$X_1 = 62.71 - .01544X_2 - .02538X_3 + .00240X_4 - .04089X_5 - .00746X_7 - .03848X_8$$

See Table 1 for description of the six independent variables.