

Early Predictors of Male Delinquency: A Review

R. Loeber and T. Dishion

Oregon Social Learning Center, Eugene, Oregon

A systematic review is presented of prediction studies on delinquency. The main aim is to identify etiological variables for delinquency that, in different studies and across different populations, show good predictive validity. To achieve this goal, a measure of predictive efficiency was chosen that could be applied to studies from the United States and from abroad. The principal predictors of delinquency were the parents' family management and techniques (supervision and discipline), the child's conduct problems, parental criminality, and the child's poor academic performance. Data are presented to show the earliest age of the child at which these predictors have been measured. Results of the prediction data are used to demonstrate utility functions in which false positive and false negative errors are minimized. Recommendations are put forward to improve prediction studies in criminality.

Claims about the early identification of youths at risk for delinquency have sometimes been extravagant. The Gluecks (Glueck & Glueck, 1950) claimed to be able to correctly identify 90% of all future delinquents. The psychiatrist Glover, testifying before the Royal Commission on Capital Punishment (1949, cited in Hakeem, 1957-1958), expressed the belief that psychometric tests could do wonders. He stated that "if sufficient trouble were taken, pathological cases liable to commit murder could be detected during early childhood" (p. 492). However, prediction research has not substantiated these claims (Hakeem, 1957-1958). Moreover, the research by Glueck and Glueck (1950, 1959), with substantial claims of predictability of delinquency, has been criticized on methodological grounds (Hirschi & Selvin, 1967; Prigmore, 1963; Reiss, 1951; Weis, 1974). On the more positive side, there is a large and rather scattered body of studies with encouraging results for the identification of youths at risk for later delinquency. These studies will be reviewed here.

Prediction in criminology serves two main purposes. More accurate prediction helps parents, teachers, court officials, and therapists to take adequate action when discovering early warning signs of a juvenile delinquent career. Second, known predictors can be used for the construction of theories of delinquency. Here some predictors are equated with causal and moderating factors that may interact and form constellations of factors likely to bring about delinquency.

Theory building and predictive assessment have a major common element: the selection and weighting of variables in terms of their explanatory power for delinquency. Some variables may only account for small differences between delinquents and nondelinquents, whereas other variables may account for much of the variance between delinquent and nondelinquent groups.

Prediction in delinquency is possible for two reasons: the first is that problem behaviors of children have a high degree of continuity over time. Problematic conduct early in life for certain groups of children tends to continue rather than abate (Gersten, Langer, Eisenberg, Simcha-Fagan, & McCarthy, 1976; Ghodsian, Fogelman, Lambert, & Tibbenham, 1980; Loeber, 1982; Olweus, 1979; Patterson, 1982; Robins, 1966; Werner & Smith, 1977; West & Farrington, 1973). The challenge is to identify conduct problems that precede delinquency and are ultimately predictive of its occurrence. This will make it

The authors are indebted to L. R. Goldberg, D. J. Farrington, J. C. Gersten, R. F. Sparks, and an anonymous reviewer for their helpful comments. The paper was the result of frequent and fruitful discussions with the staff of the Oregon Social Learning Center, especially G. R. Patterson, J. B. Reid, and P. Holleran.

Requests for reprints should be sent to R. Loeber, Oregon Social Learning Center, 207 East 5th Avenue, Suite 202, Eugene, Oregon 97401.

possible to identify on the basis of the conduct problem those children at highest risk for delinquency. Another challenge is to establish the earliest age at which such conduct problems become predictive, so that preventive efforts can take place while the conduct problems are not yet firmly stabilized. One more challenge is to detect the interrelationships between different conduct problems and to see whether this pattern is more predictive of delinquency than the individual components.

The second reason prediction in delinquency is feasible is that we know what situations or social variables tend to enhance children's eventual engagement in delinquent activities. Known circumstantial variables are, for example, the social class of the parents and the parents' child-rearing methods.

The present article has three main goals: (a) to establish a measure of predictive efficiency that can be applied to the delinquency prediction studies in our review, (b) to identify variables from the literature that predict delinquency in adolescence or in early adulthood, and (c) to use the results of the prediction data to demonstrate the utility functions of predictors and to minimize false positive or false negative errors. The article closes with methodological considerations and suggestions for improving prediction studies in criminality.

Predictive Efficiency

Researchers in criminology have used a variety of methods to assess the power or efficiency of particular variables to predict latent delinquency (Gottfredson, 1970; Simon, 1971). However, predictive methods useable on the same population are not necessarily useable on different populations, because differences in the base rates of delinquency between groups affect most measures of predictive efficiency. The following discussion outlines a method that is less sensitive to such variations and that makes it possible to compare the predictive efficiency of a wide variety of predictors over a wide range of studies. We will first explain how this method of prediction has been developed and then review studies by using this method.

The following example illustrates widely used means of assessing predictive efficiency

and their implicit limitations for clinical or prevention activities. It was selected because of the care taken by the investigators to provide complete data that permitted additional analyses. Robins and Hill (1966), in a well-designed investigation of theoretical importance, studied 296 nonwhite youths and postulated that delinquency would be highest for youths with parents from a low employment background. To begin with, they determined the employment status of the child's guardian using retrospective evidence from school records. The criterion of delinquency was defined as a police or court record by the age of 17. Ideally, the prediction of delinquency on the basis of employment status should have a high degree of accuracy. Those children with a guardian of low employment status should be more at risk for delinquency than those with a guardian of higher employment status. The results reported by Robins and Hill (1966) are shown in Figure 1: 46 out of the 148 boys with guardians of low employment status became delinquents. This was compared with 30 out of 148 boys with guardians of high employment status who also became delinquent. Robins and Hill (1966) concluded that "about a third of the boys with . . . a lower status guardian eventually became delinquent, compared with one-fifth of the remainder" (p. 331). These results provided support for the relationship between economic stress and delinquency hypothesized by Robins and Hill (1966). Whereas such an analysis is extremely useful for establishing theoretically useful relationships, its potential application to issues of prevention is limited (i.e., it would be useful only for clinical situations in which one is confronted with lower or higher class parents; the social class of the parent could then be used to predict the delinquency of the offspring).

Because it was not relevant to their theoretical hypotheses, the authors did not explicitly report on the total number of correct predictions in the table, that is, those youths who were assumed to be at risk (because of low employment background) who ultimately become delinquent, and those youths who were identified as not at risk (on the basis of higher employment background) who ultimately did not become delinquent. Robins

and Hill's (1966) evaluation of predictive efficiency is not idiosyncratic, but very typical for delinquency studies in general (e.g., Glueck & Glueck, 1950; West & Farrington, 1973; Wadsworth, 1979). Moreover, the formulation of predictive efficiency given above does not discriminate between the types of errors that are made in the process, nor do conclusions about the prediction reflect chance and maximum limits in identification.

These points can best be illustrated by using prediction methods widely used in personnel selection (Wiggins, 1973). First, the method should optimally identify youths who eventually become delinquent and identify those who do not become delinquent. The first kind of correct identifications are called *valid positives*, the second kind *valid negatives* (see Figure 1). Errors in identification are of two kinds: youths who are predicted to be at risk for delinquency but who do not become delinquent, *false positives*, and youths who are not identified to be at risk for delinquency but later become delinquent, *false negatives*. Depending on one's priorities, the percentages of false positives and false negatives should be low. Monahan

(1981) has pointed out that for judicial decisions about guilt, typically the percentage of false negatives should be low; that is, the predictors should not miss youths who are actual delinquents. For clinical decisions about treatment or prevention, the emphasis is put on reducing false positives; that is, capturing only those youths truly at risk for delinquency and minimizing the identification of those seemingly at risk but who do not become delinquent. Implicit here is the relative cost of certain types of errors for certain types of decisions. Sometimes costs and benefits of decisions in predictions are weighted. The application of such utility values will be discussed in a later section. Until then, we will treat prediction without discriminating between the relative utility of false positive or false negative errors.

Figure 1 summarizes the results obtained by Robins and Hill (1966) in terms of valid versus false positives and negatives, which have been calculated on the basis of the total number of subjects ($N = 296$). The percentage of total correct predictions consists of the sum of valid positives (15.5%) and valid negatives (40%), which amounts to 55.4%. Thus, only about half of the youths were correctly

		Delinquent	Nondelinquent		
Guardian's Low Employment Status		Valid Positives 46 (15.5%)	False Positives 102 (34.5%)	148 (50%)	
Guardian's High Employment Status		False Negatives 30 (10.1%)	Valid Negatives 118 (39.9%)	148	
		76 (25.7%)	220	296	100%

Figure 1. The relationship between juvenile delinquency and guardian's employment status as shown by the frequency of each. (Adapted from "Assessing the contribution of family structure, class and peer groups to juvenile delinquency" by L. N. Robins and S. Y. Hill, *Journal of Criminal Law, Criminology, and Police Science*, 1966, 57, 325-334. Copyright 1966 by Northwestern University School of Law. Reprinted by permission.)

identified on the basis of the guardian's employment status. The delinquency outcome of less than half of the subjects was not correctly predicted. Most of these errors in prediction were false positives (34.5%), and fewer were false negatives (10.1%).

The simplistic logic of these computations is deceptive; the values in the 2×2 prediction tables are influenced by chance and by a maximum ceiling in prediction. We will discuss each of these limiting factors.

Chance occurrence of frequencies within a 2×2 table is a function of the marginal values of the table. These marginal values represent, on one side, the number of delinquents found in the population (called *base rate*), and on the other side, the number of individuals selected as delinquent by means of the prediction method (called *selection ratio*). In Figure 1, the base rate and selection ratio, respectively, amounted to 25.7% and 50%. These proportions determine the chance occurrence of frequencies within the table (Meehl & Rosen, 1955; Wiggins, 1973). Most authors take chance occurrence into account by the calculation of chi square. In the example, Robins and Hill (1966) found that chi square equalled 3.98, which was significant at the .05 level. However, this only means that one or more cells in the 2×2 table had frequencies that could not be expected by chance alone. Although this knowledge is essential, it fails to clarify which cell frequencies deviate from what could be obtained by chance alone. As Meehl and Rosen (1955) have stated, a significance test in this case does not clarify "the number of correct decisions for individuals within [delinquent and nondelinquent] groups" (p. 194). Two cells in prediction tables are most important for assessing predictive efficiency—the valid positives and the valid negatives. For that reason, the degree that observed values in these cells deviate from random or chance values provides a more accurate assessment of predictive efficiency than is possible by means of a chi-square measure. The calculation of random correct prediction for valid positives and valid negatives has been outlined by Wiggins (1973). In the example of Robins and Hill (1966), the random correct values for valid positives and valid negatives are $76/296 \times 148/296 = .128$, and $220/296 \times 148/296 =$

.372, respectively. Translated into frequencies, the numbers expected by chance alone amount to 38 valid positives (12.8%) and 110 valid negatives (37.2%; see Figure 2). Taken together, 148 (50%) of the subjects in these two cells could be predicted by a random selection of subjects on the basis of the marginal values in the prediction table.

The random correct value can be compared with the observed correct prediction (see Figure 2). The observed valid positives and valid negatives together account for 55.4% of the correct predictions. The difference between the observed correct predictions and the random correct predictions reveals the extent to which low employment status of the guardian improved the identification of youths who would later become delinquent. In the given example, the percent improvement over chance was 5.4%. This measure, as far as we know, has been used in only one delinquency study (McCord, 1980), despite its obvious advantages. However, such a measure has different meanings from study to study. To control for this, an index was devised to represent the improvement over chance as a function of the range of its possible predictive efficiency. The range is delimited by two values: the random correct and maximum correct percentages. As has been described in detail by Loeber and Dishion (Note 1), each identification table has a maximum value for the highest correct identifications possible within the table. This maximum ceiling is determined by the base rate and selection ratio. Figure 3 shows the best possible identification given the base rate and selection ratio used by Robins and Hill (1966). The number of subjects in the cell of valid positives can only maximally be 76 because of the base rate limitation of 76 out of 296. Once this maximum value is set, the frequencies in all other cells are fixed (see Figure 3). The resulting maximum percentages of valid positives and valid negatives are 25.7% and 50%, respectively. Taken together, correct predictions in the study by Robins and Hill can never be higher than 75.7%. Thus, the percent improvement over chance in a given study always falls between the random correct value and the maximum correct value. As the difference between the latter two measures varies from study to study, it is ap-

	Delinquent	Nondelinquent	
Guardian's Low Employment Status	Valid Positives 38 (12.8%)		148
Guardian's High Employment Status		Valid Negatives 110 (37.2%)	148
	76	220	296

Figure 2. Frequencies of valid positives and valid negatives expected by chance. (Adapted from "Assessing the contribution of family structure, class and peer groups to juvenile delinquency" by L. N. Robins and S. Y. Hill, *Journal of Criminal Law, Criminology, and Police Science*, 1966, 57, 325-334. Copyright 1966 by Northwestern University School of Law. Reprinted by permission.)

appropriate to express the improvement over chance (IOC) as a function of the difference between the random correct (RC) and maximum correct (MC) values in a given study. This value will be called relative improvement over chance (RIOC), and can be calculated as follows:

$$RIOC = \frac{\%IOC}{\%MC - \%RC} \times 100$$

A major problem in the evaluation of predictive efficiency is that it depends to a great

	Delinquent	Nondelinquent	
Guardian's Low Employment Status	76 (25.7%)	72 (24.3%)	148
Guardian's High Employment Status	0	148 (50%)	148
	76	220	296

Figure 3. The distribution of cell frequencies maximizing correct predictions. (Adapted from "Assessing the contribution of family structure, class and peer groups to juvenile delinquency" by L. N. Robins and S. Y. Hill, *Journal of Criminal Law, Criminology, and Police Science*, 1966, 57, 325-334. Copyright 1966 by Northwestern University School of Law. Reprinted by permission.)

extent on how well the selection ratio matches the base rate in a given study (Loeber & Dishion, Note 1). A discrepancy between the selection ratio and the base rate, which is very common in delinquency studies, influences the magnitude of the maximum correct value. The present use of the RIOC measure, which is partly based on the maximum correct value, largely eliminates this problem. To test this, the IOC and RIOC indices were correlated with both the selection ratio and the base rate for each of the studies reviewed. It was thought that the best index of predictive efficiency would be the least correlated with either of the selection parameters. As expected, the IOC correlated .54 and .38 and the RIOC correlated .13 and .22 with the base rates and selection ratios. We concluded that the RIOC measure is more independent of varying base rates and selection ratios and therefore superior as an overall evaluative index of predictive efficiency.

Inclusions and Exclusions in the Present Review

An extensive search of the delinquency literature resulted in a large number of studies with predictive data. A description of the studies included in this review follows:

1. The studies contained data that made it possible to reconstruct prediction tables as shown in Figure 1. Studies that contained only percentage information and did not allow the reconstruction of raw scores were excluded.
2. The review focused on males, but studies on mixed male and female populations were included. Studies solely on female populations were not included.
3. Only studies that contained predictors that had taken place at least a year prior to the measurement of outcome of delinquency were included. Thus, whereas studies concurrently measuring independent and dependent variables are valuable for identification of potential predictors, such studies were not included in the present review. We included only studies that predicted juvenile delinquency and delinquency in early adulthood; that is, we included only predictors and outcomes that occurred before age 22.
4. Only studies that used objective first-hand predictors were included. It was sometimes difficult to determine whether a study met this criterion because a number of studies did not clarify the exact nature of predictor scoring. Excluded, for example, was Powers and Witmer's (1951) report on the Cambridge-Somerville study, in which teacher ratings were reported as a predictor, but these ratings were, in fact, based on the researcher's interview of the teacher or on the researcher's interpretation of written protocols of such discussions with a teacher.
5. Most of the studies referred to independent variables that predicted acceleration or an increased probability of delinquency over time. We also included studies that predicted the offset or decreased probability of delinquency later in time.
6. The prediction and outcome variables included in this review comprised not only the incidence of police contacts youths had, but also outcomes such as arrest rates, reconviction rates, and high self-reported delinquency. Wherever possible, we did not include traffic violations in delinquency outcome measures. Studies on parole violations were excluded (see, e.g., Monahan, 1981; Ohlin & Duncan, 1949).
7. Both retrospective and prospective studies were included.
8. Whenever data were presented by authors in other than dichotomized fashion, we followed the cutting scores for predictor variables mentioned by authors. If the authors did not mention cutting scores, we set the cutting scores in such a way as to obtain the most optimal improvement in prediction over chance.
9. Personality tests to identify youths at risk for delinquency were not included (see, e.g., Hathaway & Monachesi, 1953, 1963).
10. Whenever recidivism studies were reviewed, the rate of recidivism was compared with the rate of one-time offenders rather than with the rate of delinquency in general.

It should be noted that the authors of the following studies do not all emphasize the predictive utility of their studies. Many of them have emphasized theoretical or empirical aspects of their data. However, the fact that independent variables in these studies often preceded dependent variables in time allows us to examine the predictive efficiency of a wide range of independent variables.

In the following review, Tables 1 through 10 supply information on the raw scores in

(Text continues on page 78)

Table 1
Outcome Statistics for Behavioral Predictors of Delinquency

Study predictor	Valid positives	False positives		Valid negatives	False negatives		N	PBR	PSR	Definition criterion of delinquency	Prediction interval	RIOCI
		n	%		n	%						
West & Farrington (1973) Troublesomeness (teacher and peer ratings) ^a	41	51	12.4	276	43	10.5	411	20.4	22.4	One or more adjudicated offenses	8-10 ^b to 17	34.1
Farrington (1979) Troublesomeness (teacher and peer ratings)	31	60	14.7	269	49	12.0	409	19.6	22.2	21 or more self-reported acts	8-10 to 14-16	21.1
Craig & Glick (1963) Problem behavior in Grades 1, 2, & 3 (teacher ratings)	35	70	23.3	187	9	3.0	301	14.6	34.9	"Serious and/or persistent"	6-9 to 16	66.3
Mitchell & Rosa (1981) Problem behavior (parent & teacher report)	30	71	22.9	179	30	9.7	310 "deviant group"	19.3	32.6	One or more adjudicated offenses	5-15 to 20+	25.7
Kirkegaard-Sørensen & Mednick (1977) Disciplinary problem (teacher rating)	10	15	5.3	236	21	7.4	282 (select sample)	11.0	8.9	Conviction	10-20 to 23-33	32.3
Robins (1966) Antisocial referral	185	27	7.7	75	63	18.0	350 (racially mixed)	70.9	60.6	Arrest	14 to 18	48.2
Stott & Wilson (1968) Marsh (1969) Delinquency Prediction scale (teacher rating)	29	53	6.5	683	53	6.5	818	10.0	10.0	Conviction	18 to 21	27.8
Scarpitti (1964) Potentially delinquent (teacher nomination)	27	43	24.9	99	4	2.3	173	17.9	40.5	Court contact	12 to 16	78.0
Reckless & Dinitz (1972) Likelihood of future delinquency (teacher nomination)	213	881	51.0	600	32	1.9	1726 (an experimental, control, & comparison group)	14.2	63.4	Police contact	13 to 16	64.4

Table 1 (continued)

Study predictor	Valid positives	False positives		Valid negatives	False negatives		N	PBR	PSR	Definition criterion of delinquency	Prediction interval	RIOC
		n	%		n	%						
Simcha-Fagan (1979) Mother-reported delinquency	32	54	13.5	581	62	11.7	729	12.9	11.8	Police contact	7 to 12 8 to 13 11 to 15 13 to 18 14 to 20 16 to 21	28.2
Roff, Sells, & Golden (1972) Who is liked best (peer choice)	20	76	5.5	1177	100	7.3	1373	8.75	7.0	Court contact	11-12 to 16	15.3
Havighurst, Bowman, Liddle, Matthews, & Pierce (1962) Aggressiveness (teacher and peer ratings)	32	40	19.1	122	15	7.2	209	22.5	34.4	Police contact	12-13 ^c to 18-19	51.4
West & Farrington (1973) Aggressiveness (teacher rating)	23	59	15.1	264	45	11.5	391	17.4	21.0	One or more adjudicated offenses	8-10 to 17	16.4
Kirkegaard-Sørensen & Mednick (1977) Violence & aggressiveness (teacher rating)	7	20	7.1	231	24	8.5	282 (select sample)	11.0	9.6	Conviction	10-20 to 23-33	17.0
Easily angered (teacher rating)	13	50	17.7	201	18	6.4		11.0	22.3			25.2
Feldhusen, Thurston, & Benning (1973) Aggressiveness (teacher rating)	273	295	19.0	766	216	13.9	1550 (boys & girls)	31.6	36.7	Police record	9 to 17 12 to 20 15 to 23	30.3
Mulligan, Douglas, Hammond, & Tizard (1963) Aggressiveness (teacher rating)	54	189	9.2	1700	120	5.8	2063	8.4	11.8	Conviction	13 to 15	21.5

EARLY PREDICTORS

Table 1 (continued)

Study predictor	Valid positives	False positives		Valid negatives	False negatives		N	PBR	PSR	Definition criterion of delinquency	Prediction interval	RIOCI
		n	%		n	%						
Mitchell & Rosa (1981) Destructiveness (parent reported)	12	14	4.4	244	51	15.9	321 "deviant group"	19.6	8.1	Court appearance for indictable offense	5-15 to 20+	31.8
Kirkegaard-Sørensen & Mednick (1977) Passivity (teacher rating)	13	50	17.7	201	18	6.4	282 (select sample)	11.0	22.3	Conviction	10-20 to 23-33	25.2
Farrington (Note 4) Truancy	16	23	5.6	304	68	16.5	411	20.4	9.5	One or more adjudicated offenses	8-10 to 17	26.3
Robins & Hill (1966) Truancy	44	83	28.0	137	32	10.8	296 (nonwhite)	25.7	42.9	Police or court record	6-12 to 17	26.2
Mitchell & Rosa (1981) Wandering (p. 25) (parent reported)	15	23	7.2	235	48	15.0	321 "deviant group"	19.6	11.9	Court appearance for indictable offense	5-15 to 20+	24.7
Stealing (p. 24) (parent reported)	12	6	1.9	252	51	15.9		19.6	5.6			57.8
Lying (p. 25) (parent reported)	22	37	11.5	221	41	12.8	321	19.6	18.4			22.0
Farrington (Note 4) Dishonest (peer rating)	33	55	13.4	272	51	12.4	411	20.4	21.4	One or more adjudicated offenses	10 to 17	22.7
Daring (peer rating)	38	62	15.1	265	46	11.2			24.3			27.5
Daring (p. 99) (peer and parent rating)	42	79	19.3	250	38	9.3	409	19.6	29.6	21 or more self-reported acts	8-10 to 14-16	32.6
Farrington (1979) Involved in fights after drinking	49	76	19.5	223	41	10.5	389	23.1	32.1	Conviction	18 to 21	49.3
Involved in antisocial groups	39	42	10.8	257	51	13.1			20.8			32.5
Unstable job	42	50	12.9	249	48	12.3			23.6			30.0
No money saved up	54	93	23.9	206	36	9.2			37.8			35.4
Drug user	45	77	19.8	222	45	11.6			31.4			27.0

Table 1 (continued)

Study predictor	Valid positives	False positives		Valid negatives	False negatives		N	PBR	PSR	Definition criterion of delinquency	Prediction interval	RIOC
		n	%		n	%						
Prediction: Recidivism												
Mitchell & Rosa (1981)												
Problem behavior (p. 27, parent and teacher reported)	17	13	21.7	20	10	16.7	60	45.0	50.0	Two or more court appearances	5-15 to +20	26.0
Stealing (p. 29-30, parent and teacher reported)	11	3	5.3	28	15	26.3	57	45.6	24.6			60.5
Lying (pp. 29-30, parent and teacher reported) ^d	14	8	14.0	22	13	22.8	57	47.4	38.6			31.0
Osborn & West (1980)												
Unemployment over 5 weeks in last year	14	9	20.9	13	7	16.3	43	48.8	53.5	Persisting vs. tempo- rary recidivism	18 to 23	28.1
Drug taking in past year	15	7	16.3	15	6	14.0			51.2		41.6	
Self-reported aggression	15	8	18.6	14	6	14.0			53.5		38.5	
Mulligan, Douglas, Hammond, & Tizard (1963)												
Aggressiveness (teacher rating)	22	31	17.8	94	27	15.5	174	66.7	30.5	Reconviction	13 to 15	38.3
Robins (1966)												
Antisocial referral	127	133	38.0	74	16	4.6	350 (racial mix)	40.9	74.3	Three or more arrests	14 to 18	56.2
Buikhuisen & Hoekstra (1974)												
Not moved after imprisonment	188	59	13.1	82	122	27.1	451 (inmates)	68.7	54.8	One reconviction	Juveniles to 5 yrs. later	23.7
Knight & West (1975)												
Offenses committed alone	16	3	3.9	27	31	40.2	77	61.0	24.7	Continued delin- quent after age 17 vs. not cont.	17 to 18-19	59.2

Note. PBR = percent base rate; PSR = percent selection ratio; RIOC = relative improvement over chance.

^a For teacher ratings and peer ratings of troublesomeness separately as predictors of delinquency, see West and Farrington (1973) and Farrington and West (1971).

^b Average rating by different teachers at ages eight and ten.

^c Excludes 356 boys with lowest SES for whom peer ratings did not discriminate.

^d See Mitchell and Rosa (1981, p. 30) for combination of parent- and teacher-reported stealing or lying as predictor of delinquency.

the prediction table, the percentages of false positives and false negatives, and the percentages of base rate and selection ratio. The tables also indicate the brief definitions of the predictors, the criterion or outcome of delinquency, the time interval between measurements of the predictor (expressed in terms of the youth's age) and the criterion (also expressed in terms of the youth's age). Finally, as the principal evaluative index, the percentage of relative improvement over chance is provided. The first part of each table reports studies with delinquency in general as criterion, and the last part of each table reports on prediction studies of recidivists among populations of one-time offenders. The reader should keep in mind that samples in some studies were specially selected and matched with control groups (Buikhuisen & Hoekstra, 1974; McCord, 1979; Robins, 1966; Robins & Lewis, 1966; Robins, West, & Herjanic, 1975; Tait & Hodges, 1972; Trevett, 1972; Voss, 1963) and consequently have much higher base rates than unselected populations of males.

We will first review predictors of delinquency that can be measured early in a person's life. This category has been separated into two subsets: (a) predictors that are extrapolative of the subject's own behavior, such as problematic or delinquent behavior as witnessed by parents, peers, or teachers; (b) predictors that are circumstantial—that is, representing the characteristics of the subject's family or social environment (Toby, 1961). Following the section on early predictors is a brief review of predictors of delinquency evident in late adolescence.

Early Youth Behavior as a Predictor of Later Delinquency

Table 1 lists a number of studies with extrapolative predictors based on a subject's behavior prior to the occurrence of delinquency. Among the earliest predictors was the child's problem behavior over ages 6 to 9 years (Craig & Glick, 1963) that improved predictability by about 66.3%. The prediction was based on teachers' ratings of children who presented problems in the first, second, and third grades. Another set of studies (West & Farrington, 1973) showed that the child's troublesomeness at the age of 8 to 10

was also predictive of delinquency, producing a relative increment of 34.1% for official delinquency and 21.1% for high self-reported delinquency. In these studies, the degree of troublesomeness was assessed by teachers on two occasions, and in addition, peer ratings were incorporated in the assessment.

In some studies, good predictors are based on multiple assessments and/or assessment by different respondents (e.g., Craig & Glick, 1963; Havighurst, Bowman, Liddle, Matthews, & Pierce, 1962; West & Farrington, 1973). Multiple assessment has the advantage of identifying a relatively high-risk group of youngsters with stable behavior, at least across the times of assessments, but most probably also through ensuing years (see Loeber, 1982; Olweus, 1979). The use of two or more respondents, such as teachers and peers or teachers and parents, has the additional advantage that the subject's behavior is observed in more than one setting, which improves the generalizability of the findings. In addition, if these individuals are nonprofessionals or service providers who can easily be contacted, then the assessment is cost efficient as compared with that done by mental health workers. It is assumed that when the problem behavior occurs across situations, as reported by different service providers, the stability of that behavior is higher than when it only occurs in only one setting (Loeber, 1982). Moreover, multiple assessments and/or multiple respondents tend to reduce measurement error. In general, it is difficult to assess which predictors are poor because of little association with a particular outcome or because of inadequate validity or reliability of measurement. The present review, however, by considering numerous studies, partly overcomes this problem because the recurrence of particular good predictors across studies may emerge. One such predictor seems to be antisocial or problematic pre-delinquent behavior at the age of 12 to 14 years (Mitchell & Rosa, 1981; Robins, 1966; Scarpitti, 1964), which improved the prediction of delinquency by about 51% and the prediction of recidivism by about 41%.

It is very likely that these problem categories include the child's aggressiveness. Aggression at the ages of 9 to 15 years produced improvements in prediction of 34% for

delinquency in general and 38% for recidivism (Feldhusen, Thurston, & Benning, 1973; Mulligan, Douglas, Hammond, & Tizard, 1963; Havighurst et al., 1962).

Some of the specific problem behaviors in Table 1 are correlated and thus may predict the same group of individuals who eventually become delinquent. Ideally, predictors should not be highly correlated, so that the addition of each new predictor adds to the group of individuals at risk rather than confirming those individuals who already have been identified. In the context of the present review, children who are daring or disobedient are often also aggressive (DeBlois & Stewart, 1980; Robins, 1966; Loeber & Schmalting, Note 2).

The second specific problem behavior particularly predictive of recidivism is the subject's stealing as reported by teachers and parents. Mitchell and Rosa (1981) measured stealing in a sample of 5- to 15-year-olds, which improved the prediction of delinquency by 57.8% and of recidivism by 60.5%. Unfortunately, the authors do not specify at which of these ages stealing becomes not only prominent but also predictive. Moore, Chamberlain, and Mukai (1979) followed up samples of stealing, aggressive, and normal children. The first two groups had been referred for treatment between the ages of 4 and 14 years because of problem behavior. At intake, the mothers reported on the nature and frequency of the child's problematic behaviors. At follow-up 2 to 9 years later, 84% of the stealer sample had incurred a criminal record, compared with 24% of the children in the aggressive sample and 21% in the normative sample. Thus, the child's stealing as reported by a parent in the family home was highly indicative of later official delinquency.

A number of studies have shown that youths engaging in stealing are also likely to be involved in other, covert or more concealing antisocial acts such as lying, wandering, or truancy (Miller, Court, Knox, & Brandon, 1974; Patterson, 1982; Reid & Hendriks, 1973; Loeber & Schmalting, Note 2; Reid, Hinojosa-Rivero, & Lorber, Note 3). In the present review, Table 1 shows that dishonesty by the age of 10 is moderately predictive of later delinquency (Farrington, Note 4; see also Mitchell & Rosa, 1981), as is

truancy before age 12 and wandering between the ages of 5 and 15 (Mitchell & Rosa, 1981; Robins, 1966; Farrington, Note 4).

Unlike studies on older adolescents (Osborn & West, 1978, 1980), no studies on younger adolescents in our survey used composite predictors of more than one problem behavior such as, for example, high aggressiveness and theft. Considering the high improvements in prediction such composite measures have produced for the older age group (see Table 9), we anticipate sizeable improvements in prediction through the use of composite measures for the younger age group (see Loeber & Schmalting, Note 5, for some concurrent evidence). This has an added advantage because of the relative instability of problem behaviors in childhood and adolescence (Rutter, 1978). A number of longitudinal studies have shown that 30% to 43% of children who engage in maladaptive behavior at the ages of 4 to 11 years continue to show such behavior 4 to 9 years later (Farrington, 1978; Ghodsian et al., 1980; Glavin, 1972; Janes, Hesselbrock, Myers, & Penniman, 1979; Werner & Smith, 1977). Thus, 57% to 70% of the children ultimately improved and did not show the problem behavior years later. On the other hand, some who did not display problem behavior early in life revealed such behavior years later. Expressed in percentages, 12% to 27% of those who were initially free from the problem behavior, as defined by the investigators, joined the ranks of the chronic children over time (Farrington, 1978; Ghodsian et al., 1980; Janes et al., 1979). In absolute numbers, the percentages of newcomers given above refer to as large or larger numbers as the chronic risk group (Loeber & Dishion, Note 1). The presence of chronic and newcomer groups has an effect on the most profitable prediction strategy. The chronic group can be identified by means of, for example, aggressiveness. However, we assume that those who were not aggressive at the early assessment possibly showed other problem behaviors such as vandalism or lying that might eventually lead to delinquency. For that reason, we expect that composite measures of more than one precursor of delinquency will identify an optimal proportion of children at risk for delinquency.

Table 2
Outcome Statistics for the Prediction of Delinquency by Prior Delinquent Record and High Self-Reported Delinquency

Study predictor	Valid positives		False positives		Valid negatives		False negatives		N	PBR	PSR	Definition criterion of delinquency	Prediction interval	RIOC
	n	%	n	%	n	%	n	%						
McCord (1979) Juvenile delinquent records	19	11.8	18	11.8	92	15.1	23	15.1	152	27.6	24.3	Juvenile conviction for serious crimes	5-17 to 18-40	35.4
Wolfgang (Note 6) Offense before age 18	138	21.4	214	21.9	576	4.8	47	4.8	975	19.0	36.1	Re-arrest	Under 17 to 18-30	60.0
Osborn & West (1978) Prior convictions	37	15	15	14.1	30	22.6	24	22.6	106	57.6	49.1	Reconviction	8-18 to 19-23	32.0
Self-reported delinquency Polk (1975)	31	17	17	16.0	37	19.8	21	19.8	106	49.1	45.3	Reconviction	14-16 to 19-23	30.4
Delinquent at 15-16 Robins & Ratcliff (1979)	31	19	19	7.5	157	17.9	45	17.9	252	30.1	19.9	Adult criminal record	15-16 to 28	45.5
Offense before age 15	25	23	23	11.7	125	11.7	23	11.7	196	24.5	24.5	Re-arrest	Under 15 to 30-35	36.5

Note. PBR = percent base rate; PSR = percent selection ratio; RIOC = relative improvement over chance.

Investigators have a choice of including various numbers of problem behaviors in the prediction exercises. Mitchell and Rosa (1981), for example, considered the total number of child problem behaviors reported by the mother between the ages of 5 and 15 years as a predictor of delinquency. A cutting score of five or more on the total deviation measure produced an improvement of 20.8% for delinquency in general and 16.4% for recidivism (not shown in Table 9). The inclusion of child problem behaviors in this index—such as anxieties—that are not predictive of delinquency, or correlate negatively, decreases the predictive power of such an index.

Delinquency is often said to be best predicted by taking into account prior delinquency (Monahan, 1981). Studies reviewed in Table 2 reinforce this idea, and produce increments averaging 40.0% (range 30.4% to 60.0%). Two points deserve attention. First, the rate of recidivism computed over a population of youths is often very small (usually below 15%). Normally, the prediction of such low base rate events is not feasible even when multiple gating or screening methods are used (Meehl & Rosen, 1955; Wiggins, 1973). This will be reviewed briefly in the discussion. Predicting recidivists among a population of one-time offenders on the basis of prior delinquency is more realistic (see Table 2). Second, for the studies shown in Table 2, prior delinquency as a predictor of continued delinquency was measured by age 15 to 17. Compared with aggressiveness or other non-delinquent problem behavior measured at an earlier age, prior delinquency appears to become a good predictor at a slightly later age. The statement, however, should be qualified in the sense that the age range is a function of the investigator's setting of the cutting score at that age. Koller and Gosden (1980), in a retrospective study on a prison population, found an average age of 14 years for the first officially recorded offense for inmate recidivists, whereas first-time prisoners were, on the average, 21 years old when they were arrested for their first officially recorded offenses.

The minimal age of measurement of predictors may seem arbitrary in the studies discussed above. For example, why not use criminal record at age 13, or perhaps even

earlier? Perhaps with the exception of the study by Robins and Hill (1966), none of the studies systematically reviewed the predictability of measures taken over different age groups. On the one hand, problem behaviors including criminal activities need time to become recognizable as a stable phenomenon (Epstein, 1980). On the other hand, the stability of these phenomena at earlier ages than measured in the studies above may still prove sufficiently predictive of later delinquency. Clearly, only empirical research can demonstrate how much earlier predictors can be measured without losing predictive power. Such studies may make it possible to identify youngsters who are at risk for delinquency at an even earlier age than has been demonstrated up to now, especially if early precursors of delinquency are used.

Later Youth Behavior as a Predictor of Delinquency

Almost without exception, the early behaviors of the youths that are predictive of delinquency remain predictive at a later age. This is not to say that these acts occur in exactly the same form or situation when measured, for example, in early or late adolescence. What should be stressed here is the relative continuity of predictive categories, of behavior over time. For example, at age 18, involvement in fights after drinking improved predictability by 49.3%, while at that age high self-reported aggression improved the forecasting of recidivism by 38.5% (Farrington, 1979; Osborn & West, 1980). In prison populations, high aggressiveness or serious institutional misconduct is also known to be predictive of recidivism (Cowden & Pacht, 1967; Cymbalisty, Schuck, & Dubeck, 1975; Department of Corrections of the State of Michigan, 1978, cited in Monahan, 1981; Koller & Gosden, 1980). Thus aggressiveness from adolescence onward is a more or less continuous predictor of delinquency. In the same vein, unofficial theft predicts delinquency both at an early and at later ages. When property offenses are compared with offenses against people, the former seem to be more predictive of recidivism than the latter (Gendreau, Madden, & Leipziger, 1979; Koller & Gosden, 1980).

Not all predictors of delinquency measured in late adolescence necessarily occur

in the earlier age groups. Bell and Pearl (1982) speak of age-specific manifestations of risk variables. For example, property offenses are often correlated with financial hardship caused by chronic unemployment, inability to hold jobs for extended periods of time, or expensive drug habits. The occurrence of these variables before the age of 12, as an obvious example, is rare, and because of that they do not sufficiently qualify as predictors in normal populations of young adolescents. Farrington (1979) and Osborn and West (1980) have shown that by the age of 18 unstable employment and extended unemployment are highly predictive of delinquency and recidivism (see Table 1). The same studies found that drug use at that age was also predictive of delinquency and recidivism, which is in line with studies on prison populations, especially for opiate users (Gendreau et al., 1979; Koller & Gosden, 1980; Pritchard, 1979).

Empirical research is necessary to make better use of peer involvement in the prediction of delinquency. Only the Farrington (1979) study considered a measure of involvement in antisocial groups at age 18. It will come as no surprise that involvement with antisocial or delinquent peers often occurs at a much earlier age and even then can still correlate highly with delinquency (Loeber, Dishion, & Patterson, Note 7). Thus, involvement with antisocial or delinquent peers is expected to become a more important early predictor for delinquency. It should be noted, though, that committing crimes alone discriminates between persisting offenders and offenders who cease delinquent activity in late adolescence (Knight & West, 1975).

Osborn and West (1978, 1980) have drawn up two profiles of behaviors that are, together, very predictive of recidivism. One profile, shown in Table 9, consists of six behaviors; the total score improves predictions by 68.3% (Osborn & West, 1978). The other profile lists 11 behaviors. A minimum cutoff score produces a relative increment of 30.6%. This study demonstrates a well-tried method in prediction in which not all, but a minimum number, of problem behaviors or adversities are associated with an improvement in prediction (Rutter, 1978; Simon, 1971). What is important is that the predictability of individual behaviors can be augmented by ag-

gregating these behaviors into a composite profile.

Educational Achievement as a Predictor of Delinquency

The school studies in the present review (Table 3) reinforce the image of delinquency-prone children who are underachievers in an educational sense. At the end of elementary school, low achievement, low vocabulary, and poor verbal reasoning improved the prediction of delinquency by 27% (Farrington, 1979; Rutter, Maugham, Mortimer, & Ouston, 1979; Wolfgang, Figlio, & Sellin, 1972). The best predictors during the high school years were low grade point average and school retardation by age 15, which improved predictability by 33.5% and 34.1%, respectively (Polk, 1975; Robins & Hill, 1966). Again, the same point can be made about educational achievement as has been made about prior criminal activity. The minimum age at which poor educational performance becomes recognizable, stable, and predictive still needs to be better established than has been possible up until now.

Early Circumstantial Predictors of Delinquency

The circumstances in which children grow up differ vastly from one family to another. Some children live in reasonably affluent families and have loving parents who are usually aware of what their children are doing and who are not reluctant to discipline when necessary; others do not. The following section reviews a variety of early circumstantial indicators of delinquency.

Table 4 shows the socioeconomic class of the parent as a predictor of the child's later delinquency. The studies recording socioeconomic class when the child was 4 to 12 years old improved predictions by a lesser fraction: $M = 19.8\%$ (range = 10.5% to 30.9%; Farrington, 1979; Robins & Hill, 1966; Rutter et al., 1979; Wadsworth, 1979; Wolfgang et al., 1972). Only one study, by Knight and West (1975), showed a substantial improvement in prediction of 49.3% by considering social class as a predictor to distinguish those who continued their delinquent career after age 18 versus those who did not. Otherwise, socioeconomic class still proved a poor pre-

dictor for recidivism in large and less selected populations (Wolfgang et al., 1972).

Parents of a low socioeconomic status often have larger families. Farrington and West (1971) found that when a child had more than three siblings before the age of 10, the chance of delinquency for that child increased by 57.3% (see Table 5). Families are not necessarily intact all the time: family breaks or prolonged separations from parents, as shown in Table 6, led to little improvement in prediction ($M = 16.7\%$; range = 7.4% to 30.2%). What seems to matter more is overall family functioning. Craig and Glick (1963) used teacher ratings when the child was about 6 years old, which improved predictions by an estimable 80.2%. Unfortunately, it is not clear from this study which family characteristics were taken into account by the teachers. One of these characteristics may be known criminal activity by family members. Table 7 shows that when one or more parent or a sibling has had police contacts, the prediction of the youth's delinquency or recidivism is improved by 50% (range = 28.4% to 100%; Knight & West, 1975; Osborn & West, 1979; Robins, West, & Herjanic, 1975). For these studies, the relative's delinquency occurred before the child was 8 to 19 years old. This does not mean that the subject engaged in delinquent activity with the family member, for that is uncommon (Farrington, Gundry, & West, 1975). According to those authors, even when the father's official delinquency occurred prior to the child's birth, this still can augment the chance that the child will eventually become delinquent. As is shown in Table 7, the improvement in prediction is often small, even when biological or adopted fathers are taken into account as a predictor of delinquency. Only in the case of two antisocial parents or grandparents when the child was 13 does the increment in prediction rise to 49.8% (Robins & Lewis, 1966).

It can be assumed that some parents, including those diagnosed as antisocial, are less skilled in rearing children than others. Thus, in some households, parents maintain few rules, do not exercise discipline when needed, or do not supervise youngsters (Patterson, 1982). Table 8 shows only a few studies taking such parenting skills into account as single predictors. The results are disappointing,

Table 3
Outcome Statistics for Educational Predictors of Delinquency

Study predictor	Valid positives	False positives		Valid negatives	False negatives		N	PBR	PSR	Definition criterion of delinquency	Prediction interval	RIOC
		n	%		n	%						
Robins & Hill (1966, p. 329) School retardation before age 15	22	72	24.3	184	18	6.1	296 nonwhites	13.5	31.8	Police or court record	Under 15 to 17	34.1
Farrington (1979, p. 99) Low vocabulary at 10	40	87	21.3	242	40	9.8	409	14.7	31.0	21 or more self-reported acts	8-10 to 14-16	27.4
Poor school-leaving results	30	66	16.1	263	50	12.2	409	19.6	23.5		11 to 14-16	18.3
Polk (1975) Grade point average below C	30	26	10.3	105	46	15.9	252	30.2	10.3	One or more contacts with police-adult criminality	15 to 28-30	33.5
Rutter, Maugham, Mortimer, & Ouston (1979) Verbal reasoning	266	553	48.9	266	46	4.1	1131	27.6	72.4	Cautioned or found guilty	12 to 18	46.1
Wolfgang, Figlio, & Sellin (1972) Low achievement level in school	486 242	368 320	30.5 12.1	196 1632	157 448	13.0 17.0	1207 nonwhites 2642 whites	53.3 26.0	70.7 21.3	Police arrest	6-12 to 18	16.4 22.9
Wadsworth (1979) Attitude toward school work (teacher rating)	68	262	14.6	1290	178	9.9	1798	13.7	18.3	Court appearance or caution by police	10 to 20	11.2

Note. PBR = percent base rate; PSR = percent selection ratio; RIOC = relative improvement over chance.

EARLY PREDICTORS

Table 4
Outcome Statistics for Socioeconomic Status of Parents in Predicting Delinquency

Study predictor	Valid positives	False positives		Valid negatives	False negatives		N	PBR	PSR	Definition criterion of delinquency	Prediction interval	RIOCI
		n	%		n	%						
Wadsworth (1979, p. 30) Lower manual socioeconomic status	197	704	32.1	1,156	134	6.1	2,191	15.1	41.1	All reported offenses		30.9
Wolfgang, Figlio & Sellin (1972, p. 54) Low socioeconomic status												
Sample 1	763	1,377	19.6	3,649	1,254	17.8	7,043 white	28.6	30.4	Police record	4-5 to 18	10.5
Sample 2	1,293	1,151	39.7	293	165	5.7	2,902 nonwhite	50.2	84.2			28.5
Robins & Hill (1966) Guardian's low occupational status	46	102	34.5	118	30	10.1	296 nonwhite (selected sample)	25.7	50.0	Police or court record	6-12 to 17	21.0
Farrington (1979) Low social class	24	55	13.4	274	56	13.7	409	19.6	19.3	21 or more self-reported acts	8-10 to 14-16	13.2
Rutter, Maughan Mortimer, & Ouston (1979) Parental occupational group	175	310	24.9	568	192	15.4	1,245	29.5	39.0	Cautioned or found guilty	12 to 18	14.4
Prediction: Recidivism												
Knight & West (1975) Low social class	23	6	7.4	27	25	30.9	81	59.3	35.8	Continuing delinquency vs. temporary delinquency	17 to 18-19	49.3
Wolfgang, Figlio, & Sellin (1972, p. 67) Low socioeconomic status												
Sample 1	859	430	29.5	73	94	6.5	1,456 nonwhite	65.4	88.5	Recidivists vs. one-time offenders	4-5 to 18	14.0
Sample 2	395	372	18.4	738	514	25.5	2,019 whites	45.0	38.0			11.7

Note. PBR = percent base rate; PSR = percent selection ratio; RIOCI = relative improvement over chance.

Table 5
Outcome Statistics for Family Size as a Predictor of Delinquency

Study predictor	Valid positives		False positives		Valid negatives		False negatives		N	PBR	PSR	Definition criterion of delinquency	Prediction interval	RIOC
	n	%	n	%	n	%	n	%						
Prediction: Delinquency in general														
Farrington & West (1971) Three or more siblings	33		130	31.6	230	18	4.4	411	12.4	39.7	Conviction	0-10 to 14	57.3	
Wadsworth (1979) Less than two years of being only child	242		1,039	47.3	851	64	2.9	2,196	11.0	58.3	All reported offenses	2 to 21	50.0	
Prediction: Recidivism														
Osborn & West (1978) Six or more siblings	15		32	8.1	329	21	5.3	397	9.1	11.8	Two or more findings of guilt	8 to 24	33.6	

Note. PBR = percent base rate; PSR = percent selection ratio; RIOC = relative improvement over chance.

partly due to the modest reliability of the measures used by psychiatric social workers assessing the parents (West, 1969, p. 125). More recent research on parents' child-rearing skills has demonstrated that considerable improvements can be made in the measurement of such skills and, possibly, in their ultimate predictive utility (Stouthamer-Loeber, Patterson, & Loeber, Note 8). The importance of the parents' child-rearing practices is most evident from composite measures in Table 9. In fact, some studies on parenting skills produced increments ranging from 77% (Trevvett, 1972) to 82% (Craig & Glick, 1968). At the time of the assessment, children were between 5 and 17 years old in the Trevvett study and 6 years old in the Craig and Glick study, but this is not fully clear from the published reports (see also Glick, 1972). The composite measure in these studies was an abridged version of the Glueck scale, consisting of ratings of the discipline and supervision of the boy by his mother, and a rating of the family's cohesiveness. The resulting scores were weighted for the frequency of delinquency associated with each rating, and then totalled. Voss (1963) also used a three-item version of the Glueck scale, but replaced family cohesiveness with discipline of the boy by the father, improving prediction by 48.3%, but thereby limiting the assessment to two-parent families.

The original Glueck and Glueck (1950, 1959) "prediction" study has not been included in Table 9 because it was retrospective in nature and relied heavily on the respondent's recall of the youth's behavior and family functioning of 7 years earlier. In the present review, replications of the original five-item Glueck scale (Tait & Hodges, 1972) did not perform as well as the three-item version usable for single-parent families. Two reports, not included in Table 9, have appeared that show very poor predictive performances of the original Glueck scale (Dootjes, 1972; Wahlen, 1954, cited in Lundman & Scarpitti, 1978).

McCord (1979) also used a composite score of family functioning leading to an increment of 45.7%, but the computation of the total score is not clear from the published report. In summary, among all circumstantial measures, composites of family functioning produced not only the highest improve-

Table 6
Outcome Statistics for Separation from Parents and Family Conflict as Predictors of Delinquency

Study predictor	Valid positives	False positives		Valid negatives	False negatives		N	PBR	PSR	Definition criterion of delinquency	Prediction interval	RIOCI
		n	%		n	%						
Wadsworth (1980)												
Death or separation before 3 yr., 4 mo.	60	220	10.0	1,640	271	12.4	2,191	15.1	12.8	All reported offenses	8 to 21	7.4
Robins & Hill (1966)												
Father absent before age 15	26	129	43.6	128	13	4.4	296 nonwhite	9.8	52.4	Police or court record	6-15 to 17	30.2
Farrington & West (1971)												
Separation from parent through extended hospitalization	19	71	17.3	289	32	7.8	411	12.4	21.9	Conviction	0-10 to 14	19.6
Farrington (1979)												
Separated up to age 10	27	63	15.4	266	53	13.0	409	19.6	22.0	21 or more self-reported acts	0-10 to 14-16	15.0
Gregory (1965)												
Separation from parent by death or divorce	—	—	—	—	—	—	5,600	24.0	13.2	Police and court records; at least one minor offense	16 to 19	11.5
Farrington & West (1971)												
Parental disharmony	18	71	19.0	261	23	6.2	373	11.0	23.9	Conviction	8-9 to 14	26.4
Craig & Glick (1963)												
Family good/fair/poor (teacher rating)	37	21	7.0	236	7	2.3	301	14.6	19.3	"Serious and/or persistent"	6 to 16	80.2

Note. PBR = percent base rate; PSR = percent selection ratio; RIOCI = relative improvement over chance.

ments in prediction, but as in the Craig and Glick (1968) study, could probably be measured at a very early age. Moreover, composite predictors composed of family criminality, low income or socioeconomic status, family size, separation from parents, and so forth produced relative increments in prediction of 32% to 63% (May, 1981; West & Farrington, 1973; Wadsworth, 1979).

The importance of family functioning variables in the prediction of delinquency is also evident from studies showing the incidence of delinquency within families. For example, in the study samples of Farrington et al. (1975) and Wilson (1975), 47% to 62% of all offenses committed by youngsters in the sample were committed by children from 11% to 16% of all families. In fact, certain families were more at risk for delinquency than were other families. It is likely that parents' child-rearing practices set such families apart from less delinquent families (Wilson, 1975). Although the early identification of those families seems a promising avenue for delinquency prevention, such studies are still in their infancy.

Even when the object is the prediction of delinquency by youngsters rather than by members of a family, the Glueck method relies heavily on trained professionals to assess family functioning. Thus, such assessment, in sharp contrast with the teacher, parent, or peer assessment of the youngster's problem behavior, is relatively costly. Only in one study did teachers assess family functioning with good predictive success (Craig & Glick, 1963). There is an obvious need to replicate this study, as teachers are probably not usually as familiar with families as was the case in this study. Bell and Pearl (1982) have pointed out the necessity for using providers of services to children more systematically as assessors of children at risk for maladjusted behavior. They advocate a more systematic assessment of high-risk children as part of a community-based rather than a clinic-based identification program. Bell and Pearl (1982) rightly point out that such identification of high-risk children requires adequate intervention methods so that these children can be detoured from the anticipated undesirable outcome. In the process of a more widespread identification of high-risk

children, the present repertoire of known predictors can probably be expanded. This would also be an important opportunity to improve the measurement quality of existing and forthcoming predictors.

Summary of the Results of the Prediction Studies

The preceding results have been summarized in Table 10 and have been ranked in terms of median percent relative improvement over chance. Composite measures of parental family management techniques tended to be most predictive of delinquency, followed by the child's problem behavior. Reports of the child's stealing, lying, or truancy come next, followed by criminality or antisocial behavior of family members, and the child's poor educational achievement. The lowest ranking predictors are socioeconomic status and separation from parents. This ranking should be accepted with caution, as the ranges of relative improvement over chance are considerable for some categories of predictors. Table 10 also shows the ranking for the predictors of recidivism. The best predictors were reports of the child's stealing, lying, or truancy, followed by the child's own problem behavior or prior delinquency. In comparison, socioeconomic status was the worst predictor. However, again the ranges in the percent of relative improvement over chance were large. The rankings of variables predicting delinquency in general and predicting recidivism are largely in the same direction. The two rankings are only partly comparable, however, due to the absence of studies reporting on the predictive efficiency of the following variables on the youth's recidivism: parental family management techniques, the child's poor academic achievement, and the child's separation from parents.

In summary, there is no doubt that certain extrapolative and circumstantial variables greatly improve predictability. However, none of the studies reviewed here attempted to combine extrapolative and circumstantial variables to further improve predictive efficiency. It is known from prediction studies in the field of mental health that such combinations can be very fruitful. For example, Rutter (1978) used a family adversity index

Table 7
Outcome Statistics for Delinquency in Other Family Members as a Predictor of Delinquency

Study predictor	Valid positives	False positives		Valid negatives	False negatives		N	PBR	PSR	Definition criterion of delinquency	Prediction interval	RIOCI
		n	%		n	%						
Robins, West, & Herjanic (1975)												
One or both parents arrested	27	35	40.7	24	0	0	86 (nonwhite select sample)	31.4	72.1	Court or police contact before age 17 (nontraffic)	10-11 to 18+	100.0
One or both paternal grandparents antisocial	18	28	32.6	31	9	10.5	86 (nonwhite select sample)	31.4	53.5			28.4
Osborn & West (1979)												
One or more convictions for father	52	50	13.0	214	67	17.5	383	31.1	26.6	One or more convictions	8 to 24-25	29.1
One or more convictions for father or sibling	46	45	29.4	49	13	8.5	153	38.6	59.5			45.7
Farrington (1979)												
Criminal parent	35	69	16.9	260	45	11.0	409	19.6	25.4	21 or more self- reported acts	Under 10 to 14-16	24.4
Delinquent sibling	17	29	7.1	300	63	15.4	409	19.6	11.2			21.6
Hutchings & Mednick (1975)												
Criminal biological fathers (felony or misdemeanor)	21	79	7.0	914	106	9.5	1,120 (nonadopted adults)	11.3	8.9	Criminal record excluding minor offense	Unknown to 30-44	10.8
Criminal adoptive fathers (felony or misdemeanor)	39	105	9.4	834	141	12.6	1,119 (adults adopted as child)	16.1	12.9			13.0
Criminal biological fathers of adoptees (felony or misdemeanor)	80	273	28.1	534	84	8.7	971 (adults adopted as child)	16.9	36.4			19.5
Robins & Lewis (1966)												
Two antisocial parents or grandparents	9	17	25.4	37	4	6.0	67 (includes control group)	19.4	38.8	Arrest	13 to 18+	49.8

Table 7 (continued)

Study predictor	Valid positives	False positives		Valid negatives	False negatives		N	PBR	PSR	Definition criterion of delinquency	Prediction interval	RIOCI
		n	%		n	%						
Kirkegaard-Sørensen & Mednick (1977) Criminal father & schizophrenic mother	16	63	31.3	102	20	10.0	201 (sons & daughters of schizophrenic mothers)	17.9	39.3	Conviction	Unknown to 23-33	8.3
Prediction: Recidivism												
Knight & West (1975) Parent or sibling convicted before S's age 10	31	9	11.1	24	17	21.0	81	59.3	49.4	Delinquency continued after age 17 vs. not cont.	9 to 18-19	44.8
Osborn & West (1979) Father with two or more convictions	56	34	18.4	61	34	18.4	185	48.6	48.6	Two or more convictions of son	8 to 24-25	26.4

Note. PBR = percent base rate; PSR = percent selection ratio; RIOCI = relative improvement over chance.

Table 8
Outcome Statistics for Parenting Variables as Predictors of Delinquency

Study predictor	Valid positives		False positives		Valid negatives		False negatives		PSR	Definition criterion of delinquency	Prediction interval	RIOC
	positives	n	%	n	positives	n	%					
Farrington (1979) Poor parental supervision (see West, 1969, pp. 73-74)	29	50	12.2	279	51	12.5	409	19.3	19.6	21 or more self-reported acts	8 to 14-16	21.2
Poor parental child rearing	27	71	17.3	258	53	13.0	409	24.0	19.6			13.1
West & Farrington (1973) Authoritarian mother (see West, 1969, pp. 178-180)	23	59	20.3	180	29	10.0	291	28.2	17.9	Conviction	9-10 to 17	22.6

Note. PBR = percent base rate; PSR = percent selection ratio; RIOC = relative improvement over chance.

containing both a measure of the subject's early behavior and measures derived from the subject's family environment. The resulting analysis showed that the risk of psychiatric disorders accelerated when four or more adversities were present. Similar combinations of circumstantial and extrapolative predictors have been used by Werner and Smith (1982) to predict which of those high-risk youths would be resilient and not show later maladjusted behavior. In the study of delinquency, we need to allow such examples, if only to make predictors as powerful as possible. Another important reason is that a better understanding of causal variables in delinquency is possible not only by identifying those variables predicting delinquency, but also by discovering the variables forecasting absence of criminal behavior. These in a sense negative predictions are most useful to better understand why certain youths do not engage in delinquent activities, even when their peers or relatives do so or even when they reside in a neighborhood characterized by antisocial lifestyles, unemployment, and ample opportunities for crime.

Figure 4 illustrates which early predictors of delinquency produced the best results. It shows the age of the child when various predictors were last measured, graphed against the measure of the percent relative improvement over chance. If we can be assured of the correctness of Craig and Glick's (1963) data, family characteristics when the child was 6 years old were both the earliest and among the best predictors. From 9 years onward, specific and generally problematic behaviors appear as predictors, with antisocial referrals, aggressiveness, and predelinquency being the best predictive triad. At age 10, parent criminality appears to be very predictive of later child delinquency, at least as measured retrospectively in Robins et al.'s (1975) study on a select sample. At age 15, grade point average becomes predictive, and a year later high self-reported delinquency and officially recorded delinquency come to the fore. These "minimum" ages for predictors are, as mentioned, not the result of systematic research. We anticipate that empirical studies will further decrease the age at which children can be reliably identified as at risk for delinquency.

The Evaluation of Delinquency Prediction Through Utility Estimation

The concern with simple accuracy in criminological prediction is the policy underlying our use of the measures of relative improvement over chance. These indices do not consider the errors concomitant with the valid predictions within a study. It is often the case, however, that investigators are not neutral to the two types of prediction errors (i.e., false positives and false negatives). One investigator may be primarily concerned with minimizing the false positive errors in a prediction strategy to reduce the economical cost of treating individuals not actually in need of treatment. Conversely, another investigator may be concerned with reducing false negative errors for the purpose of adequately covering the population of potential criminal offenders in a prevention program. A well-established component of personnel selection and decision theory involves the numerical estimation of the overall utility of selection or prediction procedures by attaching differential weights to false positive and false negative errors (Cronbach & Gleser, 1965; Rorer, Hoffman, Hsieh, 1965; Wiggins, 1973). The advantages of utility estimation in criminological prediction are (a) utility values assigned to each prediction outcome provide a representation of the institutional or personal values underlying a prediction procedure, (b) the overall utility of various prediction strategies may be evaluated diversely according to the idiosyncratic concerns of various institutions or social service settings, and (c) optimum cutting scores may be rationally selected that maximize the overall utility of a prediction procedure (Rorer et al., 1965).

The assignment of utility cost and gain values in criminological prediction is clearly a subjective process. One prediction strategy may be said to be superior to another only relative to a specific utility estimation policy. As examples three utility estimation policies are presented in Figure 5. The first policy consists of using our measure of relative improvement over chance, which assumes the same utility values for false positive and false negative errors. Policy 2 assigns a cost value to false negative errors (EU_1), and Pol-

icy 3 assigns a cost value to false positive errors (EU_2).

The computational formula for the expected utility (EU) of a prediction strategy recommended by Wiggins (1973) is

$$EU = U_1 \times p(VP) + U_2 \times p(FP) + U_3 \times p(FN) + U_4 \times p(VN),$$

where $p(VP)$ is the probability of a valid positive, $p(FP)$ is the probability of a false positive, $p(FN)$ is the probability of a false negative, $p(VN)$ is the probability of a valid negative, and U_i is the utility value of the outcome.

Wiggins (1973) further suggests that the cost of testing be estimated on the utility scale and incorporated into this formula. We have simplified the formula by eliminating the estimated cost of testing.

We will now reevaluate four of the prediction studies (Craig & Glick, 1963; Polk, 1975; Robins, 1966; Scarpitti, 1964) discussed above, using the three utility estimation policies (including the total percent correct and the relative improvement over chance as one). Table 11 provides the base rate, selection ratio, total percent correct, relative improvement over chance, and the expected utilities of the two alternative policies (EU_1 and EU_2).

Note that, depending on the evaluation index one adopts, the rank-ordered preference of the four studies radically varies. The Craig and Glick (1963) study is superior to the other three studies according to EU_1 because a cost is assigned to false negative errors. However, on EU_2 , the Craig and Glick study is ranked third in terms of overall utility. Although the four studies are relatively equal according to the total percent correct, their rates of false positive and false negative errors determine their practical utility in the two hypothetical applications. The reader is invited to use these utility policies on further studies in our review, or apply other utility functions adjusted to needs to those studies.

Methodological Considerations and Recommendations in Prediction Studies

In this section we will consider prediction methodology in delinquency research and

Table 9
Outcome Statistics on Composite Measures as Delinquency Predictors

Study predictor	Valid positives	False positives		Valid negatives	False negatives		N	PBR	PSR	Definition criterion of delinquency	Prediction interval	RIOC
		n	%		n	%						
Tait & Hodges (1972) Glueck's Prediction Table (5 factors)	77	26	22.4	9	4	3.5	116 (selected sample)	69.8	88.8	Known to juvenile court	5 to 14	56.4
Trevvett (1972) Modified Glueck's Prediction Table (3 factors)	119	15	9.3	23	5	3.1	162 (same as Tait & Hodges)	76.5	82.7			76.9
Craig & Glick (1968) Modified Glueck's Prediction Table (3 factors)	28	5	1.7	252	16	5.3	301	14.6	11.0	"Serious & persistent delinquents"	6 to 16	81.9
Voss (1963) Modified Glueck's Prediction Table (1 parent: 2 factors) (2 parents: 3 factors)	13	24	10.8	176	10	4.5	223 (whites, nonwhites, Puerto Ricans)	10.3	16.6	Police contact?	6 to 12	48.3
McCord (1979) Home atmosphere: 1. Mother affection 2. Supervision 3. Parental conflict 4. Parental aggress. 5. Mother's self-confidence 6. Father's deviance 7. Father's absence	27	19	9.5	133	21	10.5	200	24.0	23.0	One or more conviction for serious crime	5-13 to 21+	45.7
West & Farrington (1973) Combination of 1. parent criminality 2. low family income 3. poor parental behavior	10	4	1.0	323	74	18.0	411	20.4	3.4	Conviction	8-10 to 17	63.0

Table 9 (continued)

Study predictor	Valid positives	False positives		Valid negatives	False negatives		N	PBR	PSR	Definition criterion of delinquency	Prediction interval	RIOC
		n	%		n	%						
Wadsworth (1979)												
1. Birth order	136	711	39.2	915	50	2.8	1,812	10.3	46.7	Court appearance or cautioned by police	0 to 21	49.5
2. Family size												
3. Family growth												
4. Parental divorce, separation, or death												
5. Lengthy hospital stay												
6. Social group												
Prediction: Recidivism												
Osborn & West (1980)												
1. 9 wks. unemployed	19	9	20.5	13	3	6.8	44	50.0	63.6	Persisting vs. temporary recidivism	18 to 23	68.3
2. Heavy smoking												
3. Heavy drinking												
4. Sexual intercourse with more than one partner												
5. Drug use												
6. Involved in fights												
Osborn & West (1978)												
Antisociality (score of 5 or more on 11 self-reported antisocial behaviors: see West & Farrington, 1977, p. 195)	33	19	18.6	33	7	16.7	102	49.0	50.1	Reconviction	18 to 19–23	30.6
May (1981)												
Social Disadvantage Score (score of 4 or more out of 16 items)	341	842	14.9	4082	389	6.9	5654	12.9	20.9	Police contact	11–16 to 13–18	32.4

Note. PBR percent base rate; PSR = percent selection ratio; RIOC = relative improvement over chance.

recommend ways in which prediction efficiency may be improved.

A formidable problem in criminology involves the use of police contact or court adjudication as prediction criteria. Hood and Sparks (1970, p. 12) have specified two major problems with the use of criminal justice statistics as a criterion variable in crime causation studies: (a) individuals engaging in identical delinquent behavior who remain undetected by law enforcement personnel are virtually ignored; and (b) factors explaining delinquent behavior are theoretically entangled with factors responsible for official processing. Hood and Sparks suggest further that

we must start, not with known delinquents, but with representative samples of the juvenile population drawn without regard to their known or probable delinquent histories. Then, on the basis of interviews, questionnaires, and tests we must differentiate these samples into delinquents and nondelinquents of various degrees and kinds. (1970, p. 46)

A majority of the prediction studies we have reviewed here rely on court records as the only criterion of juvenile delinquency. This is quite reasonable given that juvenile delinquency is usually defined as a legal phenomenon, that is, juvenile delinquency refers to youths having contact with police and court

officials for law-violating behavior. However, criminological prediction research would benefit from the use of multiple criteria for juvenile delinquency. Some suggested criteria of delinquency are self-reported delinquency, parent-reported delinquency, teacher-reported school behavior problems, and peer nominations of antisocial behavior.

Another consideration to be made when developing a prediction procedure or evaluating past work in criminological prediction is the base rate (i.e., violation rate) of the principle criterion variable. As Meehl and Rosen (1955) have discussed, the overall accuracy of prediction decreases as the incidence of the criterion variable decreases. This phenomenon is evident in the prediction studies reviewed here. For example, only 7 of the 71 delinquency prediction studies with criterion base rates less than or equal to 30% improve over the accuracy obtainable from the base rate prediction alone. In contrast, 17 of the 32 prediction studies with criterion base rates greater than 30% exceeded the overall accuracy of the base rate prediction. Meehl and Rosen (1955) argue that the utility of low baserate prediction is severely limited by the fact that the overall accuracy is likely to be less for predictions based on an expen-

Table 10
Rank Order of Predictors of Delinquency and Recidivism in Terms of Median Relative Improvement Over Chance (Summarized from Tables 1-9)

Predictor	RIOC	
	<i>Mdn</i>	Range
For delinquency		
1. Composite measures of parental family management techniques	.50	.31-.82
2. Child problem behavior	.32	.15-.78
3. Stealing, lying, or truancy	.26	.22-.58
4. Criminality or antisocial behavior of family members	.24	.08-1.0
5. Poor educational achievement	.23	.11-.46
6. Single measures of parental family management techniques	.23	.13-.23
7. Separation from parents	.20	.07-.80
8. Socioeconomic status	.18	.10-.31
For recidivism		
1. Stealing, lying, or truancy	.46	.31-.60
2. Child problem behavior	.38	.26-.56
3. Criminality or antisocial behavior of family members	.36	.26-.45
4. Prior delinquency	.36	.30-.60
5. Socioeconomic status	.14	.12-.49

Note. RIOC = relative improvement over chance.

sive test battery than for mere base rate predictions.

Obviously, one mode of attacking the low base rate problem in criminological prediction is to restrict prediction efforts to criteria with base rates approaching the optimal 50% level (Meehl & Rosen, 1955). Most recidivism studies based on samples of first-time offenders report recidivism rates of approx-

imately 50%. If an alternative criteria of delinquency is adopted—for example, self-reported delinquency—cutting scores may be established that provide an optimal base rate for prediction.

A recent development in the prediction of delinquency involves the systematic application of a multiple stage assessment battery to a successively reduced risk sample. This

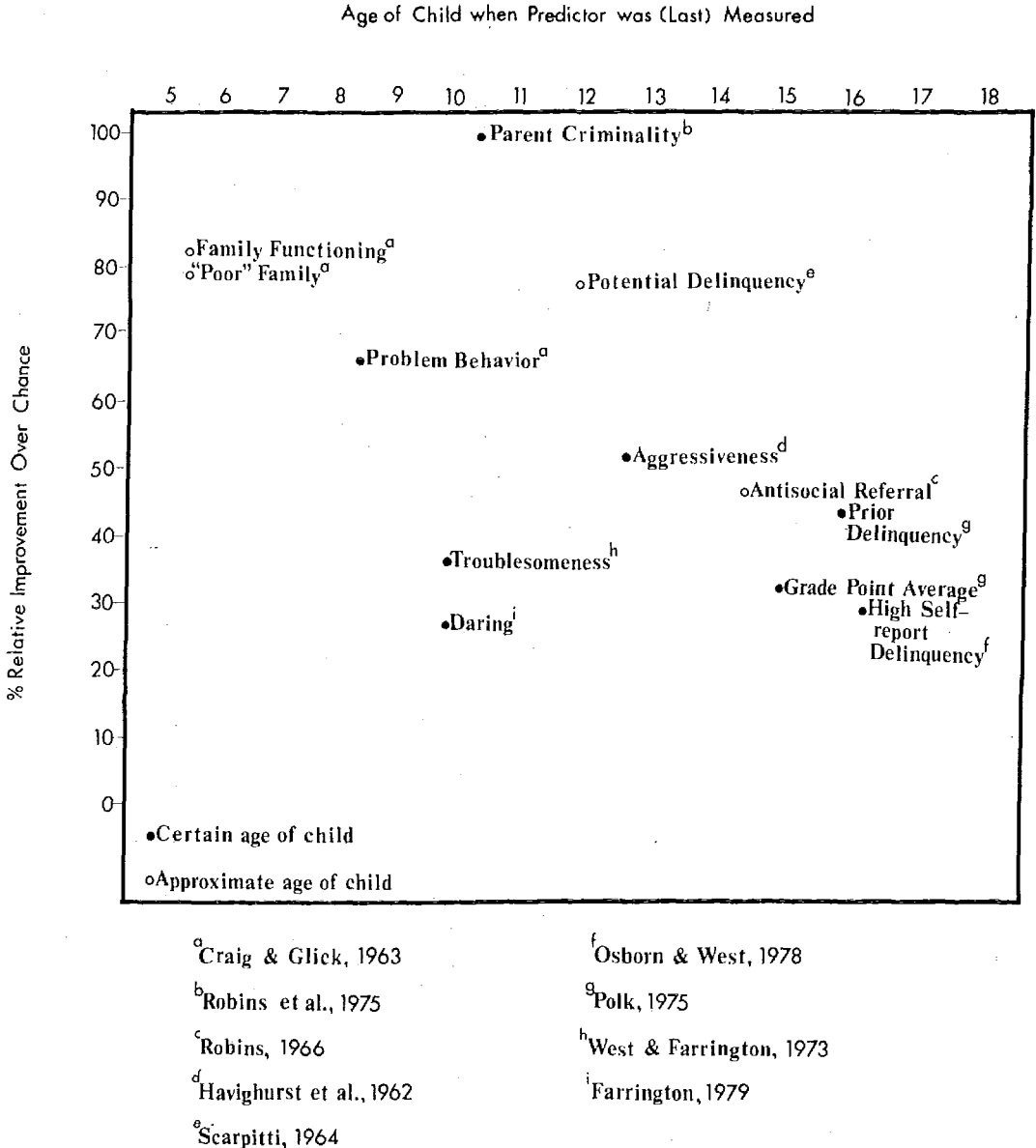


Figure 4. The accuracy of various predictors of delinquency in relation to the age of the child at the time of prediction.

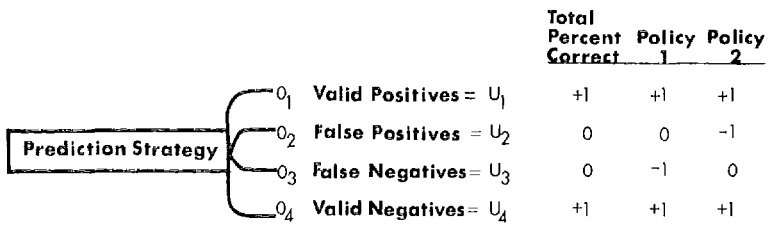


Figure 5. The utility values assumed for the total percent correct index compared with two alternative utility estimation policies.

procedure has been labeled *multiple gating* by Loeber, Dishion, and Patterson (Note 7) and is adapted from the field of personnel selection (Cronbach & Gleser, 1965; Wiggins, 1973). In the multiple gating procedure each assessment stage (i.e., predictor) is seen as a screening gate. The procedure being developed by the above investigators involves applying the first gate to a full sample of both risk and nonrisk subjects. On the basis of the first gate, a given proportion of subjects is temporarily defined as a risk group and is further assessed at the second gate. Based on the scores of the second gate, a smaller proportion of subjects is temporarily defined as a risk group and is retained for further assessment on the third gate. The final gate provides for the final formulation of a group predicted to be at high risk for future delinquency. The hypothesized result of each gate in the multiple gating procedure is the successive increase in base rates and the decrease in false positive errors, without a concomitant increase in false negative errors. The inclusion and order of predictor variables in the multiple-gating design involves two primary considerations: (a) the lowest economic cost of administering the predictor instruments, and (b) the correlations between the

predictor and criterion, and, further, the intercorrelations between the predictor variables. The best prediction battery would include predictors with relatively strong predictor-criterion correlations and low interpredictor correlations.

Finally, we will make three general comments concerning method and geographic factors in the cross-validation of identification studies. Regarding method factors, Farrington (1978) has compared various statistical prediction methods and found that the use of simple Burgess-type weights, unlike discriminant analysis and multiple regression, are less susceptible to shrinkage in cross-validation. Dawes and Corrigan (1974) also found that unit weightings perform satisfactorily in comparison to optimal weighting strategies and are most robust when the research is cross-validated. Duncan and Ohlin (1949) found that the predictive validity of prediction strategies diminished as the validation sample differed in sample parameters from the construction sample. Reiss (1951) concurs with these results and further demonstrates that inefficient and psychometrically unstable predictors have limited predictive validity. These authors' results suggest that to ensure optimal predictive validity in

Table 11
Evaluation of Six Delinquency Prediction Studies Using Diverse Utility Estimation Policies

Study	Base rate	Selection ratio	Total % correct	RIOC	EU ₁	EU ₂
Craig & Glick (1963) (Teacher ratings)	14.6	34.9	73.8	.66	.708	.505
Polk (1975) (School achievement)	30.2	10.3	71.4	.34	.532	.611
Robins (1966) (Antisocial referral)	70.9	60.6	74.3	.48	.563	.666
Scarpitti (1964) (Teacher rating of potentially delinquent)	17.9	40.5	72.8	.78	.705	.480

Note. RIOC = relative improvement over chance; EU₁ = Expected Utility Policy 1 (cost value attached to false positive errors); EU₂ = Expected Utility Policy 2 (cost value assigned to false negative errors).

cross-validation, one needs to include a small number of stable and efficient predictors with a high criterion-predictor correlation within the prediction battery. It is also advantageous to construct a prediction strategy from a sample homogeneous with the target population.

Second, there is a clear need to cross-validate screening measures to identify youths at risk for delinquency in different geographical areas to replicate promising criminological prediction results. As Rutter (1978) has shown in the field of child psychopathology, diverse geographical areas can be characterized by risk factors that only partly overlap. The present review indicates that many predictors from different locales operate in the same direction, although their predictive efficiency may vary from site to site. Such generality makes it possible to develop screening instruments that can be widely used.

These suggestions are provided in the conviction that improved methodology applied to criminological prediction will result in improved predictive efficiency. It is further reasonable to propose that through the systematic testing of objective predictors and a rigorous adherence to sound empirical procedures, our understanding of causal processes leading to criminal careers will be greatly enhanced.

Reference Notes

1. Loeber, R., & Dishion, T. J. *Strategies for identifying at-risk youths in the context of children's development*. Unpublished manuscript, 1981. (Available from the Oregon Social Learning Center, 207 East 5th, Suite 202, Eugene, Oregon).
2. Loeber, R., & Schmalings, K. B. *Empirical evidence for overt and covert patterns of antisocial conduct problems*. Unpublished manuscript, 1982.
3. Reid, J. B., Hinojosa-Rivero, G., & Lorber, R. *A social learning approach to the outpatient treatment of children who steal*. Unpublished manuscript, 1980. (Available from the Oregon Social Learning Center, 207 East 5th, Suite 202, Eugene, Oregon 97401.)
4. Farrington, D. P. Personal communication, 1981.
5. Loeber, R., & Schmalings, K. B. *The utility of differentiating between mixed and pure forms of antisocial child behavior*. Unpublished manuscript, 1982.
6. Wolfgang, M. E. *From boy to man—From delinquency to crime*. Paper presented at the National Symposium on the Serious Juvenile Offender, State of Minnesota, Minneapolis, Minnesota, September 19–20, 1977.
7. Loeber, R., Dishion, T. J., & Patterson, G. R. *Multiple gating: A multi-stage assessment procedure for identifying youths at risk for delinquency*. Unpublished manuscript, 1981.

8. Stouthamer-Loeber, M., Patterson, G. R., & Loeber, R. *Parental monitoring and antisocial child behavior*. Unpublished manuscript, 1981.

References

- Bell, R. Q., & Pearl, D. Psychosocial change in risk groups: Implications for early identification. *Journal of Prevention in Human Services*, 1982, 1(4).
- Buikhuisen, W., & Hoekstra, H. A. Factors related to recidivism. *British Journal of Criminology*, 1974, 14, 63–69.
- Cowden, J. E., & Pacht, A. B. Predicting institutional and post release adjustment of delinquent boys. *Journal of Consulting Psychology*, 1967, 31, 377–380.
- Craig, M. M., & Glick, S. J. Ten years experience with the Glueck Social Prediction Table. *Crime and Delinquency*, 1963, 9, 249–261.
- Craig, M. M., & Glick, S. J. School behavior related to later delinquency and nondelinquency. *Criminologica*, 1968, 5, 17–27.
- Cronbach, L. J., & Gleser, G. C. *Psychological tests and personnel decisions*. Urbana: University of Illinois Press, 1965.
- Cymbalisty, B. Y., Schuck, S. Z., & Dubeck, J. A. Achievement level, institutional adjustment, and recidivism among juvenile delinquents. *Journal of Community Psychology*, 1975, 3, 289–294.
- Dawes, R. M., & Corrigan, B. Linear models in decision making. *Psychological Bulletin*, 1974, 81, 95–106.
- DeBlois, C. S., & Stewart, M. Aggressiveness and antisocial behavior in children: Their relationships to other dimensions of behavior. *Research Communications in Psychology, Psychiatry, and Behavior*, 1980, 5, 303–312.
- Dootjes, I. Predicting juvenile delinquency. *Australian and New Zealand Journal of Criminology*, 1972, 5, 157–171.
- Duncan, O. D., & Ohlin, L. E. The efficiency of prediction in criminology. *American Journal of Sociology*, 1949, 54, 441–452.
- Epstein, S. The stability of behavior. I. Implications for psychological research. *American Psychologist*, 1980, 35, 780–806.
- Farrington, D. P. The family background of aggressive youths. In L. A. Hersov, M. Berger, & D. Shaffer (Eds.), *Aggression and antisocial behavior in childhood and adolescence*. Oxford: Pergamon Press, 1978.
- Farrington, D. P. Environmental stress, delinquent behavior, and conviction. In I. G. Sarason & C. D. Spielberger (Eds.), *Stress and anxiety* (Vol. 6). Washington, D.C.: Hemisphere, 1979.
- Farrington, D. P., Gundry, G., & West, D. J. The familial transmission of criminality. *Medicine, Science, and the Law*, 1975, 15, 177–186.
- Farrington, D. P., & West, D. J. A comparison between early delinquents and young aggressives. *British Journal of Criminology*, 1971, 11, 341–358.
- Feldhusen, J. F., Thurston, J. R., & Benning, J. J. A longitudinal study of delinquency and other aspects of children's behavior. *International Journal of Criminology and Penology*, 1973, 1, 341–351.
- Gendreau, P., Madden, P., & Leipziger, M. Norms and recidivism for first incarcerates: Implications for pro-

- gramming. *Canadian Journal of Criminology*, 1979, 1-26.
- Gersten, J. C., Langner, T. S., Eisenberg, J. S., Simcha-Fagan, D., & McCarthy, E. D. Stability and change in types of behavioral disturbances of children and adolescents. *Journal of Abnormal Child Psychology*, 1976, 4, 111-127.
- Ghodsian, M., Fogelman, K., Lambert, L., & Tibbenham, A. Changes in behaviour ratings of a national sample of children. *British Journal of Social and Clinical Psychology*, 1980, 19, 247-256.
- Glavin, J. P. Persistence of behavior disorders in children. *Exceptional Children*, 1972, 38, 367-376.
- Glick, S. J. Identification of predelinquents among children with school behavior problems as a basis for multiservice program. In S. Glueck & E. Glueck (Eds.), *Identification of predelinquents*. New York: International Medical Books, 1972.
- Glueck, S., & Glueck, E. *Unraveling juvenile delinquency*. Cambridge, Mass.: Harvard University Press, 1950.
- Glueck, S., & Glueck, E. *Predicting delinquency and crime*. Cambridge, Mass.: Harvard University Press, 1959.
- Gottfredson, D. M. Assessment of predictive methods. In N. Johnston, L. Savitz, & M. E. Wolfgang (Eds.), *The sociology of punishment and aggression*. New York: Wiley, 1970.
- Gregory, I. Introspective data following childhood loss of a parent: I. Delinquency and high school drop out. *Archives of General Psychiatry*, 1965, 13, 99-109.
- Hakeem, M. A critique of the psychiatric approach to the prevention of juvenile delinquency. *Social Problems*, 1957-1958, 5, 194-205.
- Hathaway, S. R., & Monachesi, E. D. (Eds.), *Analyzing and predicting juvenile delinquency with the MMPI*. Minneapolis: University of Minnesota Press, 1953.
- Hathaway, S. R., & Monachesi, E. D. *Adolescent personality and behavior*. Minneapolis: University of Minnesota Press, 1963.
- Havighurst, R. J., Bowman, P. H., Liddle, G. P., Matthews, C. V., & Pierce, J. V. *Growing up in River City*. New York: Wiley, 1962.
- Hirschi, T., & Selvin, H. C. *Delinquency research: An appraisal of analytic methods*. New York: Free Press, 1967.
- Hood, R., & Sparks, R. *Key issues in criminology*. London: Weindenfeld & Nicholson, 1970.
- Hutchings, B., & Mednick, S. A. Registered criminality in the adoptive and biological parents of registered male criminal adoptees. In R. R. Fieve, D. Rosenthal, & M. Brill (Eds.), *Genetic research in psychiatry*. Baltimore, Md.: Johns Hopkins University Press, 1975.
- Janes, C. L., Hesselbrock, V. M., Myers, D. G., & Pennington, J. H. Problem boys in young adulthood: Teacher ratings and 12-year follow-up. *Journal of Youth and Adolescence*, 1979, 8, 453-472.
- Kirkegaard-Sorenson, L., & Mednick, S. A. A prospective study of predictors of criminality. In S. A. Mednick & K. O. Christiansen (Eds.), *Biosocial bases of criminal behavior*. New York: Gardner Press, 1977.
- Knight, B. J., & West, D. J. Temporary and continuing delinquency. *British Journal of Criminology*, 1975, 15, 43-50.
- Koller, K. M., & Gosden, S. D. Recidivists: Their past and families compared with first time only prisoners. *Australian and New Zealand Journal of Criminology*, 1980, 13, 117-123.
- Loeber, R. The stability of antisocial and delinquent child behavior: A review. *Child Development*, 1982, 53, 1431-1446.
- Lundman, R. J., & Scarpitti, F. R. Delinquency prevention: Recommendations for future projects. *Crime and Delinquency*, 1978, 24, 207-220.
- Marsh, R. W. The validity of the Bristol Social Adjustment Guides in delinquency prediction. *British Journal of Educational Psychology*, 1969, 39, 278-282.
- May, R. D. The Aberdeen delinquency study. In S. A. Mednick, A. E. Baert, & B. P. Bachmann (Eds.), *Prospective longitudinal research*. Oxford: Oxford University Press, 1981.
- McCord, J. Some child-rearing antecedents of criminal behavior in adult men. *Journal of Personality and Social Psychology*, 1979, 9, 1477-1486.
- McCord, J. Patterns of deviance. In S. B. Sells, R. Crandall, M. Roff, J. S. Strauss, & W. Pollin (Eds.), *Human functioning in longitudinal perspective*. Baltimore, Md.: Williams & Wilkins, 1980.
- Meehl, P. E., & Rosen, A. Antecedent probability and the efficiency of psychometric signs, patterns, or cutting scores. *Psychological Bulletin*, 1955, 52, 194-216.
- Miller, F. J. W., Court, S. D. M., Knox, E. G., & Brandon, S. *The school years in Newcastle upon Tyne*. London: Oxford University Press, 1974.
- Mitchell, S., & Rosa, P. Boyhood behavior problems as precursors of criminality: A fifteen-year follow-up study. *Journal of Child Psychology and Psychiatry*, 1981, 22, 19-33.
- Monahan, J. *Predicting violent behavior: An assessment of clinical techniques*. Beverly Hills, Calif.: Sage Press, 1981.
- Moore, D. R., Chamberlain, P., & Mukai, L. A follow-up comparison of stealing and aggression. *Journal of Abnormal Child Psychology*, 1979, 7, 345-355.
- Mulligan, G., Douglas, J. W. B., Hammond, W. H., & Tizard, J. Delinquency and symptoms of maladjustment. *Proceedings of the Royal Society of Medicine*, 1963, 56, 1083-1086.
- Ohlin, L. E., & Duncan, O. D. The efficiency of prediction in criminology. *American Journal of Sociology*, 1949, 54, 441-452.
- Olweus, D. Stability of aggressive reaction patterns in males: A review. *Psychological Bulletin*, 1979, 86, 852-857.
- Osborn, S. G., & West, D. J. The effectiveness of various predictors of criminal careers. *Journal of Adolescence*, 1978, 1, 101-117.
- Osborn, S. G., & West, D. J. Conviction records of fathers and sons compared. *British Journal of Criminology*, 1979, 19, 120-133.
- Osborn, S. G., & West, D. J. Do young delinquents really reform? *Journal of Adolescence*, 1980, 3, 99-114.
- Patterson, G. R. *A social learning approach, Vol. 3: Coercive family process*. Eugene, Oregon: Castalia Publishing Company, 1982.
- Polk, K. Schools and the delinquency experience. *Criminal Justice and Behavior*, 1975, 2, 315-338.
- Powers, E., & Witmer, H. *An experiment in the prevention of delinquency: The Cambridge-Somerville youth study*. New York: Columbia University Press, 1951.
- Prigmore, C. S. An analysis of rater reliability on the

- Glueck scale for the prediction of juvenile delinquency. *Journal of Criminal Law, Criminology, and Police Science*, 1963, 54, 30-41.
- Pritchard, D. A. Stable predictors of recidivism: A summary. *Criminology*, 1979, 1, 15-21.
- Reckless, W. C., & Dinitz, S. *The prevention of juvenile delinquency*. Columbus: Ohio State University Press, 1972.
- Reid, J. B., & Hendriks, A. F. C. J. A preliminary analysis of the effectiveness of direct home intervention for treatment of predelinquent boys who steal. In L. A. Hamerlynck, L. C. Handy, & E. J. Mash (Eds.), *Behavior therapy: Methodology, concepts, and practice*. Champaign, Ill.: Research Press, 1973.
- Reiss, A. J. The accuracy, efficiency, and validity of a prediction instrument. *American Journal of Sociology*, 1951, 56, 552-561.
- Robins, L. N. *Deviant children grow up: A sociological and psychiatric study of sociopathic personality*. Baltimore, Md.: Williams & Wilkins, 1966.
- Robins, L. N., & Hill, S. Y. Assessing the contribution of family structure, class and peer groups to juvenile delinquency. *Journal of Criminal Law, Criminology, and Police Science*, 1966, 57, 325-334.
- Robins, L. N., & Laws, R. G. The role of the antisocial family in school completion and delinquency: A three-generation study. *Sociological Quarterly*, 1966, 7, 500-514.
- Robins, L. N., & Ratcliff, K. S. Risk factors in the continuation of childhood antisocial behavior into adulthood. *International Journal of Mental Health*, 1979, 7, 96-116.
- Robins, L. N., West, P. A., & Herjanic, B. L. Arrests and delinquency in two generations: A study of black urban families and their children. *Journal of Child Psychology and Psychiatry*, 1975, 16, 125-140.
- Roff, M., Sells, S. B., & Golden, M. M. *Social adjustment and personality development in children*. Minneapolis: University of Minnesota Press, 1972.
- Rorer, L. G., Hoffman, P. J., & Hsieh, K.-C. Utilities as base-rate multipliers in the determination of optimum cutting scores for the discrimination of groups of unequal size and variance. *Journal of Applied Psychology*, 1965, 50, 364-368.
- Rutter, M. Family, area, and school influences in the genesis of conduct disorders. In L. A. Hersov, M. Berger, & D. Shaffer (Eds.), *Aggression and antisocial behavior in childhood and adolescence*. Oxford: Pergamon Press, 1978.
- Rutter, M., Maugham, G., Mortimer, P., & Ouston, J. *15,000 hours—Secondary schools and their effects on children*. Cambridge, Mass.: Harvard University Press, 1979.
- Scarpitti, F. R. Can teachers predict delinquency? *The Elementary School Journal*, 1964, 65, 130-136.
- Simcha-Fagan, O. The prediction of delinquent behavior over time: Sex-specific patterns related to official and survey-reported delinquent behavior. In R. G. Simmons (Ed.), *Research in community and mental health: An annual compilation of research*. Greenwich, Conn.: JAI Publishing, 1979.
- Simon, G. H. *Prediction methods in criminology*. London: Her Majesty's Stationery Office, 1971.
- Stott, D. H., & Wilson, D. M. The prediction of early-adult criminality from school-age behaviour. *International Journal of Social Psychiatry*, 1968, 14, 5-8.
- Tait, C. D., & Hodges, E. F. Follow-up study of Glueck Table applied to a school population of problem boys and girls between the ages of five and fourteen. In S. Glueck & E. Glueck (Eds.), *Identification of predelinquents*. New York: Intercontinental Medical Books, 1972.
- Toby, J. Early identification and intensive treatment of predelinquents: A negative view. *Social Work*, 1961, 6, 3-13.
- Trevvett, N. B. Identifying delinquency-prone children. In S. Glueck & E. Glueck (Eds.), *Identification of predelinquents*. New York: Intercontinental Medical Book, 1972.
- Voss, H. T. The predictive efficiency of the Glueck Social Prediction Table. *Journal of Criminal Law and Criminology*, 1963, 54, 421-430.
- Wadsworth, M. E. J. *Roots of delinquency, infancy, adolescence, and crime*. Oxford, England: Robertson, 1979.
- Wadsworth, M. E. J. Early life events and later behavioral outcomes in a British longitudinal study. In S. B. Sells, R. Crandall, M. Roff, J. S. Strauss, & W. Pollin (Eds.), *Human functioning in longitudinal perspective*. Baltimore, Md.: Williams & Wilkins, 1980.
- Weis, K. The Glueck Social Prediction Table: An unfulfilled promise. *Journal of Criminal Law and Criminology*, 1974, 65, 397-404.
- Werner, E. E., & Smith, R. S. *Kauai's children come of age*. Honolulu: University Press of Hawaii, 1977.
- Werner, E. E., & Smith, R. S. *Vulnerable, but invincible: A longitudinal study of resilient children and youth*. New York: McGraw-Hill, 1982.
- West, D. J. *Present conduct and future delinquency*. London: Heinemann, 1969.
- West, D. J., & Farrington, D. P. *Who becomes delinquent?* London: Heinemann, 1973.
- Wiggins, J. S. *Personality and prediction: Principles of personality assessment*. Reading, Mass.: Addison-Wesley, 1973.
- Wilson, H. Juvenile delinquency, parent criminality, and social handicap. *British Journal of Criminology*, 1975, 15, 241-250.
- Wolfgang, M. E., Figlio, R. M., & Sellin, T. *Delinquency in a birth cohort*. Chicago: University of Chicago Press, 1972.

Received March 12, 1982

Revision received December 27, 1982 ■