論文

The Quantitative Analysis of Juvenile Delinquency in Contemporary Japan (Part 3)[1]

OKABE Takeshi

Chapter 8 Factors Relevant to Recidivism—Consideration Based on Longitudinal Delinquency Record Data in Prefecture B

This chapter examines factors leading to juvenile recidivism (hereinafter referred to as "recidivism factors").

To study recidivism factors, the offending juvenile must be tracked to determine whether repeat offenses occur, and thus, data enabling such tracking is required.

First, what exactly constitutes delinquency needs to be considered; furthermore, what is deemed as recidivism needs to be considered. The first question links directly to the subject of our analysis, while the second question could be viewed as the problem of formulating an operational definition of recidivism.

Section 1 Previous Research

Subject of Analysis and Review of Previous Research on the Definition of Recidivism

Focusing on these points, a review of previous research pertaining to domestic recidivism factors can be classified into three types.

The first type is research focusing on juveniles arrested by police. In this type of research, further arrests are generally perceived as recidivism. While this research generally comprises studies tracking delinquency over a predetermined number of years and studies that conduct tracking until adulthood, some studies, such as that conducted by Mugishima and Matsumoto (1966), extend the tracked period until after adulthood.

The second type is research that targets juveniles placed in juvenile detention centers. In this type of research, merely being placed in a juvenile detention center generally constitutes recidivism. While few in number, some studies, such as those by Sato et al. (1985) and Okamoto (2002), conduct tracking into adulthood.

---

[1] This paper is the English translation of chapter 8 of the author's original book in Japanese published in 2013, whose title is *Gendai Nihon no Shonen Hiko*. The author thanks Crimson Interactive Pvt. Ltd. (Ulatus) – www.ulatus.jp for their assistance in manuscript translation and editing. The papers translating chapters 1‐7 of that book are Okabe (2016) and Okabe(2017).

The third type is research that studies juveniles placed in reformatories. There are many examples of this type of research, and the definition of recidivism is centered around placement in a reformatory, or re-placement into a facility, including prison. While also few in number, some studies, such as those by Kayaba et al.(1986) and Kayaba et al.(1987), also follow cases into adulthood.

In addition to these three types of research, there are also studies of juveniles with cases pending in Family Court (Nagoya Family Court 1996); however, this type of research has not yet been sufficiently accumulated.[2]

All these studies have strengths and weaknesses. The greatest strength of the second (juvenile detention centers) and third (reformatories) types is that they enable acquisition of evidence for determining suitability of considering differential judgment and treatment (Yuma and Kanazawa 2001; Yuma and Kashiwagi 2007).

Furthermore, juvenile detention centers and reformatories have abundant information about the range of living environments for individual juveniles as well as about individual behavior and awareness. One advantage of these studies is the ability to research multilaterally various factors believed to lead to recidivism.

However, juveniles placed in juvenile detention centers represent only about 10% of all the juveniles arrested and youth in reformatories represent only about one fourth of that number. In other words, the second and third types of research are directed toward studying sample populations largely constituted of juveniles with high risk of recidivism to begin with, which must be considered while interpreting. For example, only the first type of research studies focus on whether juveniles initially arrested for relatively minor offenses, such as shoplifting, will reoffend.

Review of Previous Research by Analytical Method

The selection of analytical methods is an extremely important issue in studying recidivism factors because the validity of obtained results differs greatly, depending on the analytical method.

Much related research released domestically prior to 1980 involved studies using cross tabulation to explore the relationship between recidivism and some factors. However, analysis by cross tabulation is technologically difficult with multiple factors (Mori and Hanada 2007).

Multivariate analysis is needed to clarify these problems. Among the various types of multivariate analysis methods, survival time analysis[3] (which introduces explanatory variables) is recognized as useful in studying recidivism factors.

While various methods are included in survival time analysis, the most representative are the Kaplan–Meier Method (Kaplan and Meier 1958) and the Cox Proportional Hazard Model (Cox 1972, 1975).

While this paper provides an overview of these methods later, survival time analysis in essence is

---

[2] Yamamoto (2008) discusses specific methods for researching delinquency careers utilizing the Family Court's "Juvenile Case Processing System" and demonstrates his own analytical examples. The Family Court systematically maintains delinquency records for juveniles that include the final disposition classification. Progress of future research is awaited.

[3] Survival time analysis is also referred to as "failure rate analysis" in engineering and "event history analysis" in the social sciences. "Survival time analysis" (also referred to as "survival analysis") is its most common name and is often used in medicine and biology (Nakai 2005).

a generic name for analytical methods that observe individual differences (in medicine and biology, these are individual differences in the survival times of the participants) in the passage of time until a certain event occurs; the methods seek factors that influence those differences. In addition to its widespread application to medicine and biology since the latter half of the 1960s, and particularly in clinical research (validation studies on drug effectiveness, etc.) with humans participants, survival time analysis was also used in immunological research to evaluate and determine risk factors for onset of disease, in toxicity evaluation using rats and mice for cancer testing, and in reliability engineering to analyze the lifespan of systems and parts (Ohashi and Hamada 1995).

Survival time analysis application in criminal research began in the 1970s, and its utility has come to be widely acknowledged among crime and delinquency career researchers overseas by the latter half of the 1980s. The study of crime/delinquency recidivism using survival time analysis is believed to have been introduced by Schmidt and Witte (1988). This method was subsequently introduced into Japan (Harada 1989a, 1989b, Tsutomi 1991), and was first applied to actual data in domestic criminal research by Harada and Tamura (1990).

While subsequent domestic research has not progressed much, noteworthy research findings have surfaced in recent years, including Yuma and Kanazawa (2001), Mori et al. (2004), Yuma et al. (2006), Watanabe (2007), Mori and Hanada (2007), Mori and Tsutomi (2007), Yuma and Kashiwagi (2007), and Oe et al. (2008). With the exceptions of Mori et al. (2004) and Watanabe (2007), these researchers' participants of analysis were primarily juveniles. Of these (with the exception of Oe et al. (2008)), five have examined factors relating to recidivism. Due to reasons mentioned previously, these five studies currently represent the most reliable findings related to recidivism factors.

Survival time analysis is most useful in researching recidivism factors because it enables use of analytical information related to the passage of time before recidivism occurs. Another major advantage is that tracking periods do not need to be established. Although cross tabulation and logistic regression analyses that set random tracking periods and establish whether recidivism occurs within a given period are commonly used in multivariate analysis, the results change in accordance with changes in the length of tracked periods. The basis for establishing tracking periods is weak, and these methods are not immune from criticism that such settings are arbitrary (Yuma and Kashiwagi 2007).

Furthermore, because of major advantages such as the ability to conduct analysis by incorporating factors that change over the passage of time and the ability to analyze information for cases in which observation has been aborted,[4] survival time analysis is most suited to examination of recidivism factors.

This chapter's research goal is to clarify what type of variables and the degree to which these variables impact juvenile recidivism. Based on review of previous research, I expect to derive conclusions with a high degree of validity and potential for general applicability regarding this question, by applying survival time analysis to police department juvenile delinquency record data.

[4] In research that tracks recidivism, the starting point in time for tracking differs with the case, and consequently, in many situations, the tracking period varies by case. Even in such circumstances, all cases can be incorporated into analysis by using survival time analysis.

Section 2 Research Method

Data

Delinquency records (as of the end of August 2007) from Prefecture B (a prefecture within the Greater Tokyo Area) for individuals born between October 1987 and September 1988 were used. These records included information about each juvenile and their circumstances, including the date of offense, its crime type, and the arrest record for each time that the juvenile was arrested in Prefecture B for a Penal Code violation, a Special Law offense, or being deemed likely to commit crimes. Delinquency records were provided in electronic data format to the National Research Institute of Police Science (the main research body) from police departments in Prefecture B. The author was a principal researcher.

In this chapter, research participants were 1,433 individuals, including male juveniles who had committed a delinquent act while attending middle school, leading to an initial arrest. The birth date was used to determine whether the individual was attending school. Of the 1,433 individuals, the percentage rearrested before August 2007 was 38% (548 individuals). The tracking period for criminal careers was four years and five months, or three years and five months after graduation from middle school. In terms of juveniles' ages, the longest tracking period continued to the age of 19 years and 11 months, and the shortest until the juvenile reached the age of 18 years and 11 months. Due to data restrictions, population transfers outside of Prefecture B were not considered.

The reason for restricting analysis to subjects currently attending middle school was the desire to consider the impact of difficulty adapting to school on recidivism, as will be discussed later. Adding cases after graduation from middle school into the analysis would create the need to exclude individuals who were not students and thus create a bias in the sample. Furthermore, because the meaning of "difficulty adapting to school" is considered to differ depending on academic level, such as elementary, middle, or high school, it was determined preferable to limit the analysis to control the impact "difficulty adapting to school" has on delinquency.

The total number of records (cumulative number of arrestees) was 2,561. In other words, the average total number of arrests per individual was 1.8 (2,561 ÷ 1,433). Table 8-1 shows distribution of delinquency records by number of occurrences (arrests).

Table 8-1. Distribution of Delinquency Records by Number of Occurrences

Number of Occurrences	Frequency	Ratio as %
1 occurrence	885	61.8%
2 occurrences	289	20.2%
3 occurrences	121	8.4%
4 occurrences	49	3.4%
5 occurrences	41	2.9%
6 or more occurrences	48	3.3%
Total	1,433	100.0%

Variables Showing Intervals before Repeated Offense

The operational definition of recidivism is "additional incidents of arrest by police." Among variables showing the interval before a repeat offense is the interval (number of days) after an offense leading to initial arrest until another committed offense leading to the next arrest. If there is no record of repeated arrests, then it is the number of days from the offense leading to initial arrest until the last day in August 2007. The average of these values, or the average number of tracked days, was 451 for individuals with repeat offenses and 1,797 for individuals with no repeat offense.

Candidates for Variables that Explain Recidivism

While there are limits on variables that explain recidivism based on the utilized data itself, the variables were chosen by primarily referencing the previously mentioned five studies based on survival time analysis (Yuma and Kanazawa 2001; Yuma et al. 2006; Mori and Hanada 2007; Mori and Tsutomi 2007; and Yuma and Kashiwagi 2007). Moreover, each of these previous studies tracked juveniles placed in detention centers.

The first variable considered was age at the time of offense that led to initial arrest (initial age). According to previous research, Yuma and Kanazawa (2001) and Yuma et al. (2006) reported on late onset juvenile delinquency, claiming that lower initial ages lead to risk of significantly higher recidivism. On the other hand, according to analysis of the same participants (limited to those who received differential judgment for referral to reformatories) conducted by Yuma and Kashiwagi (2007), initial age at delinquency was not included in optimal models for predicting recidivism.

Although existence of a relationship between low age at initial offense and risk of recidivism is believed to conform to practitioners' feelings, whether police department record data actually proves this is worthy of verification.

The second variable is degree of delinquency at the time of initial offense, which serves as the starting point for tracking recidivism. Yuma and Kanazawa (2001) and Yuma et al. (2006) presented findings on late onset juvenile delinquency that show juveniles with a history of incarceration in reformatories have significantly higher risk of recidivism than juveniles without such history. In addition, Mori and Tsutomi (2007) indicated a relationship between history of motorcycle gang affiliation and recidivism. In this chapter, binary variables (brutality/violence) are used to analyze whether brutal or violent crime was applicable at the time of initial arrest.

The third variable pertains to guardians. With regard to late onset delinquency, although Yuma and Kanazawa (2001) and Yuma et al. (2006) asserted that recidivism decreases when juveniles experience affection toward their parent(s), analysis of the same participants (limited to those who received differential judgment for referral to reformatories) reported that this variable deviates from optimal models (Yuma and Kashiwagi 2007). Furthermore, Mori and Hanada (2007) concluded that, for cases involving first arrest for a serious crime, namely robbery resulting in injury, risk of recidivism increases when one parent is not present.

While two variables of "parent is present or absent (regardless of death or separation)" and "nurturing attitude of parent(s)" are used in this chapter's analysis, both variables are based on determination by police department personnel at the time of initial arrest. The first variable has two

possible values “both parents are present” (including adoptive father (mother) and stepfather (stepmother)) or “other” (parent(s) is not present). In one case, however, this item was returned as “unknown,” and thus, the case was dropped from analysis. With regard to the nurturing attitude of parent(s), if either parent was found neglectful, fickle, doting, prone to denial, or practicing excessive interference, the case was deemed to have a “problem with nurturing.”

The fourth and last variable is “problems adapting at school.” Actually, none of the previously mentioned five studies have analyzed this point.[5] While the reason for this is unknown, it may be the case that this was not perceived as a meaningful variable because many juveniles placed in detention centers have problems adapting at school in the first place.

However, Harada (1991) who conducted analysis of juveniles arrested by police based on 1970 BC data observes major significance in the inability to adapt at school as a risk factor for recidivism. Therefore, I considered it necessary to include this variable in the present analysis. Individuals deemed to have a history of being “negligent in their studies” as determined by police department personnel at the time of their initial arrest, were treated as individuals with problems adapting at school.

Table 8-2 shows distributions for each variable. Cross tabulations of each variable and presence/absence of recidivism are shown in Table 8-3.

Table 8-2. Distribution of explanatory variables (unit: %)

Age at time of first offense (initial age)		
Aged 12 yrs		4.6
Aged 13 yrs		22.5
Aged 14 yrs		47.7
Aged 15 yrs		25.1
Crime type of first offense (brutal / violent)		
Brutal / violent crime (=1)		11.3
Motorbike theft	(=0)	7.0
Bicycle theft		12.1
Shoplifting		21.4
Other theft		8.2
Theft of unsupervised property		33.4
Other penal code violations		5.1
Violations of special law		0.7
Deemed likely to commit crimes		0.8
Parents present / not present (parent not present)		
Parent not present (=1)		26.8
Both parents present (=0)		73.2
Nurturing attitude of parent(s) (problems with nurturing)		
Problems exist (=1)		26.6
No problem (=0)		73.4
Problems adapting at school		
Problems exist (=1)		8.4
No problem (=0)		91.6

[5] There is a report regarding intelligent quotients, believed to be associated with inability to adapt to school, concluding that the higher the intelligence quotient, the less the likelihood of recidivism (Mori and Hanada 2007).

Table 8-3. Relationship between value of explanatory variables and recidivism (unit: %)

Age at time of first offense (initial age)	no recidivism	recidivism occurred
Aged 12 yrs (n=66)	50.0	50.0
Aged 13 yrs (n=323)	57.3	42.7
Aged 14 yrs (n=684)	62.3	37.7
Aged 15 yrs (n=360)	66.9	33.1

Crime type of first offense (brutal / violent)	no recidivism	recidivism occurred
Brutal / violent crime (n=162)	48.1	51.9
Motorbike theft (n=101)	46.5	53.5
Bicycle theft (n=173)	62.4	37.6
Shoplifting (n=306)	75.2	24.8
Other theft (n=118)	56.8	43.2
Theft of unsupervised property (n=479)	63.9	36.1
Other penal code violations (n=73)	52.1	47.9
Violations of special law (n=10)	70.0	30.0
Deemed likely to commit crimes (n=11)	36.4	63.6

Parents present / not present (parent not present)	no recidivism	recidivism occurred
Parent not present (n=384)	52.9	47.1
Both parents present (n=1,048)	65.0	35.0

Nurturing attitude of parent(s) (problems with nurturing)	no recidivism	recidivism occurred
Problems exist (n=381)	49.3	50.7
No problem (n=1,052)	66.3	33.7

Problems adapting at school	no recidivism	recidivism occurred
Problems exist (n=121)	40.5	59.5
No problem (n=1,312)	63.7	36.3

Harada (1991: 48) indicated that “Inability to adapt at school during the middle school period exacerbates short-term delinquency limited to the time while attending school.” In this chapter, the author seeks to investigate whether this statement applies to subjects of analysis (BCs from October 1987 to September 1988). Data used by Harada (1991) are police records from the same prefecture as data used in this chapter, which enables convenient comparison of the two different cohorts.

For examination, a variable showing whether the individual is currently attending middle school (“currently attending” was assigned the value of 1, and “other” was assigned the value of 0—hereafter referred to as “attending”) was created,[6] and interactions between variable “attending” and “problems adapting at school” were postulated. The new variable expressed by accumulation of the two variables (“attending * problems adapting at school”) was always 0 for the sample with no problems adapting at school; however, for those who had problems adapting to school, the value of 1 was assigned only for the

[6] Using the sample born in October 1987 as an example, the interval from April 1, 2000 to March 31, 2003 had a value of 1, while after April 1, 2003 had a value of 0. This type of variable is referred to as “a variable that varies with time” (Allison 1984: 37-40).

time the individual was attending.

Analytical Method

First, cases were separated into groups according to each candidate variable for explaining recidivism (mentioned above). Cumulative survival rate curves for each group were then calculated using the Kaplan–Meier method (Kaplan and Meier 1958), and log rank tests for equivalence (Mantel 1966; Cox 1972) were conducted.

Further, variables with resultant significance from these tests (variables with a recognized relationship with recidivism) were input as explanatory variables. Analysis was then conducted using the Cox proportional hazards model (Cox 1972, 1975), with the time until recidivism (number of days) as the explained variable. Using this method, the impact of each variable was extracted in the form of coefficients, and tests were conducted to determine the statistical significance of each variable's impact. The codes for input explanatory variables are shown in Table 8-2, with each variable, other than age at the time of initial arrest, as a binary variable.

An overview of the Kaplan–Meier method is as follows. Each of an "n" number of study participants has a value for the time until a repeat offense is committed or until observation is censored. Once subjects are sorted by shortest time value, the survival ratio "p_i" (ratio of those who did not reoffend) is defined as the time period "t_i" until an individual "$_i$"reoffends (or until observation is censored).

If observation is not censored: $p_i = (n - i) \div (n - i + 1)$
If observation is censored: $p_i = 1$

Now, once cumulative survival rates until point in time t_i are applied to P_i:

$$P_i = p_1 \times p_2 \times \ldots \times p_i$$

The result is cumulative survival rates derived by the Kaplan–Meier method. Plotting resulting values on the vertical axis and time on the horizontal axis, results in depiction of a cumulative survival rate curve ("survival curve").

Furthermore, cases for which "observation was censored" in this chapter's analysis are defined as those who were not rearrested by the last day of August 2007. Following common practice of the Kaplan–Meier method for the survival curve depicted in this chapter, a vertical line is input at the point in time that shows censoring of observation in a case.

The log-rank test is an application of the chi-square test approach, which is used as the test for independence of the cross tabulations, It determines equivalence based on whether the null hypothesis (that the two survival curves depicted for each group are equivalent) is rejected.

An overview of the Cox proportional hazards model is as follows. Here, juveniles who did not reoffend at point in time "t" are considered. When the probability that a juvenile, at some unknown probability, reoffended before the point in time $(t + \delta)$ is expressed as $\Pr\{t \leqq T < t + \delta\}$, the resultant $\lambda(t)$

is referred to as the hazard ratio (function) that the juvenile did not reoffend by point in time "t."

$$\lambda(t) = \lim_{\delta \to 0} \frac{\Pr\{ t \leqq T < t + \delta \}}{\delta}$$

Then, by replacing the explanatory variables that impact recidivism with numerical variables x_1, x_2, … x_k, the hazard model is expressed as follows:

$$\log \lambda(t) = c_0(t) + c_1 x_1 + ... + c_k x_k$$

While $\lambda(t)$ cannot have a negative value, it can take a value of plus infinity to minus infinity by using logarithm.

Here, $c_0(t)$ shows changes of the hazard ratio with the passage of time. Constants c_1, c_2, … c_k show the degree that recidivism risk is impacted by the explanatory variable. The standard error and p values for these constants can be derived by maximum likelihood estimation. If constant c_1 has a positive value, the hazard ratio increases with x_1. In other words, the larger the value of x_1, the more likely that recidivism will occur.

Furthermore, if all explanatory variables input into the proportional hazard model do not change according to time, the modeling prerequisite is that hazard ratios among individuals are uniform (proportional hazard) at any point in time. In this chapter, testing of each explanatory variable was conducted based on Schoenfeld residuals (Schoenfeld 1982) to verify that there were no violations in proportional hazard assumptions.

This test is an expansion of the residuals analysis approach in normal regression analysis, which holds that rejection of the null hypothesis (that Schoenfeld residual for a given variable does not depend on time) equates to violations in proportional hazard assumptions.[7]

Survival time analysis incorporating explanatory variables can be done under parametric assumptions about hazard functions. However, the proportional hazard model is known to be suitable for analyzing the effect of explanatory variables on a hazard (Yamaguchi 1987).

Section 3 Analytical Results

Analysis using the Kaplan–Meier Method

Survival curves by "initial age" are shown in Fig. 8-1. Log-rank testing with the null hypothesis of whether the four groups as a whole originate from the same population resulted in a rejection level of

[7] In this chapter, Schoenfeld residuals were first calculated for each variable. Next, rank variables in ascending order by survival time were formulated for each case after excluding censored cases. Finally, correlation coefficients for Schoenfeld residuals and the same rank variable were calculated for each variable. If the correlation coefficient equals 0, it indicates that the Schoenfeld residual is not dependent on time. Proportional hazard assumptions were verified depending on whether this null hypothesis was rejected.

10% ($\chi^2_{(3)}$ = 6.27, p = 0.099). Furthermore, from these four groups, pairs of two random groups were created (in total, six pairs can be created), and the same tests were performed for each pair. The results showed that the survival curves differed for each of the following pairs: Aged 12 and 14 ($\chi^2_{(1)}$ = 2.72, p = 0.099), Aged 12 years and 15 ($\chi^2_{(1)}$ = 4.18, p = 0.041), and Aged 13 and Aged 15 ($\chi^2_{(1)}$ = 2.78, p = 0.096). Although no significant differences were found among other pairs, results could be interpreted as suggesting an overall tendency that the lower the age at initial offense the higher the risk of reoffense.

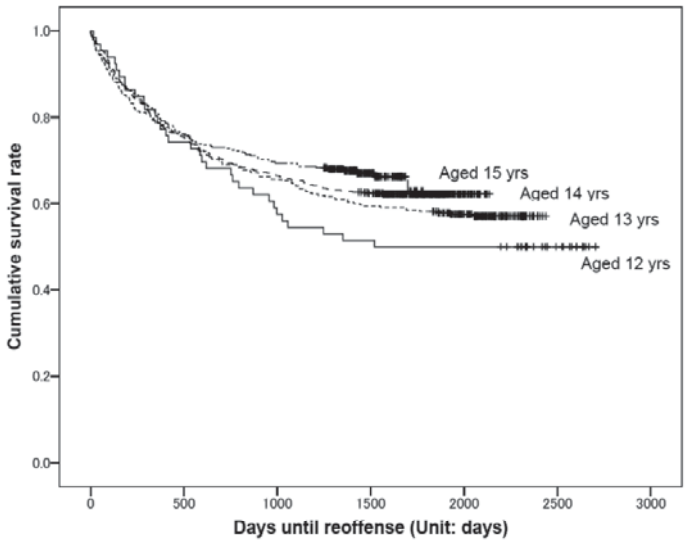

Fig. 8-1. Survival Curve by Variable (Initial Age) Values

Survival curves for each “brutal/violent” value are shown in Fig. 8-2. Results of log-rank tests determined that these differ significantly ($\chi^2_{(1)}$ = 18.85, p = 0.000). The “brutal/violent offense” curve was always depicted lower than the “not brutal/violent offense” curve, suggesting that recidivism risk is higher for those who commit a brutal/violent offense.

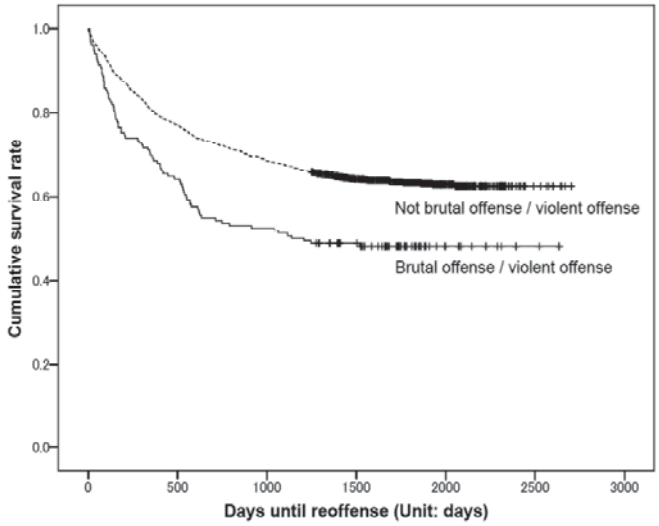

Fig. 8-2. Survival Curve by Variable (Brutal / Violent) Values

Fig. 8-3 shows survival curves for each “parent not present” value. One “unknown” case was excluded. The results of log-rank tests show significant difference ($\chi^2_{(1)} = 20.56$, $p = 0.000$). Because the “parent not present” curve was always lower, it can be interpreted that the variable of “parent not present” increases risk of recidivism.

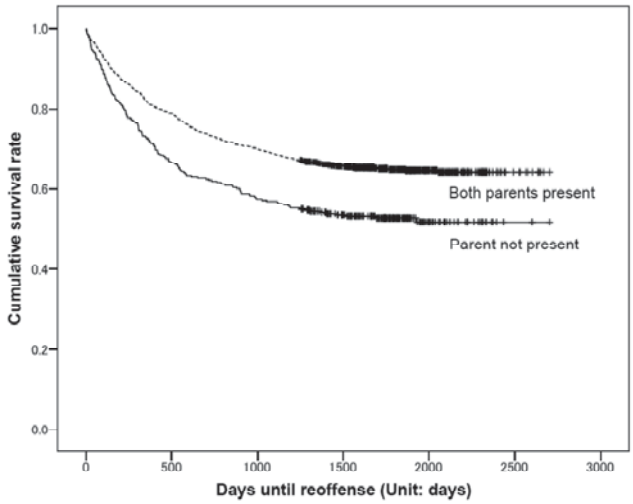

Fig. 8-3. Survival Curve by Variable (Parent Not Present) Values

Survival curves for each value for the variable “problem with nurturing” are shown in Fig. 8-4. Results of log-rank testing showed significant difference ($\chi^2_{(1)} = 42.78$, $p = 0.000$). The curve for “problem exists” was always depicted as lower. Hence, it can be interpreted that risk of recidivism is relatively higher when such a problem exists.

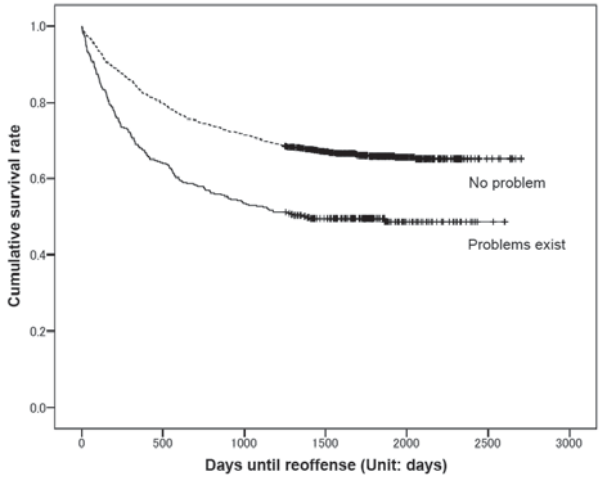

Fig. 8-4. Survival Curve by Variable (Problems with Nurturing) Values

Survival curves by whether there were “problems adapting at school” are depicted in Fig. 8-5. The results of log-rank tests showed significant difference ($\chi^2_{(1)} = 33.18$, $p = 0.000$). Because the curve for problems adapting at school was always lower than the curve for no problems adapting at school, risk of recidivism is higher when there are problems adapting to school compared with cases with no such problems.

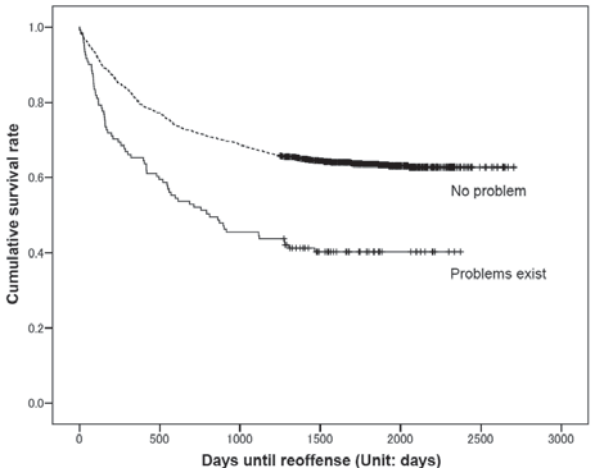

Fig. 8-5. Survival Curve by Variable (Problems Adapting at School) Values

Analysis using the Cox Proportional Hazard Model

Using the Cox proportional hazard model, verification of proportional hazard assumptions was conducted based on Schoenfeld residuals for variables for which relationship with recidivism was determined. There are no problems with any of the variables.

Next, all the above mentioned variables were input into explanatory variables, and analysis using Cox proportional hazard model was conducted. One case with the value of "unknown" in the "parent not present" variable was excluded.[8] Estimation results for the model are shown in Table 8-4. The model shows significant hazard risk at the 1% level.

Table 8-4. Proportional Hazard Model Estimation Results 1

Explanatory variable	Coef.	exp (coef.)	p-value
Initial age	−0.14	0.87	0.007
Brutal / violent	0.39	1.47	0.001
Parent not present	0.30	1.35	0.001
Problems with nurturing	0.40	1.49	0.000
Problems adapting at school	0.46	1.59	0.000
			−2LL = 7,627.26

All the explanatory variables that were input could be interpreted as having a significant impact on risk of recidivism. In other words, risk of recidivism increases when there are "problems adapting at school," "problems with nurturing," when a "parent is not present," and when the violation at the time of initial arrest was for a "brutal/violent" offense. Moreover, risk of recidivism also increases when "initial age" is low.

The exponential (coefficient) for each variable, or in other words, the hazard ratios, for individuals having problems adapting at school is 1.6 times that of individuals with no problems adapting

[8] With regard to correlation coefficients among explanatory variables, the greatest was 0.24 between the variable "problem with nurturing" and the variable "problems adapting at school."

at school. Assuming that other conditions are equal, this means that the instantaneous probability of recidivism at a given time for an individual with problems adapting at school is 1.6 times that of an individual with no problems adapting at school. That is, the average period before an individual not having problems at school reoffends is 1.6 times longer than an individual who has problems adapting at school.

Similarly, juveniles for whom a “problem exists” in the nurturing attitude of parent(s) have hazard ratios 1.5 times those of juveniles whose parent(s) having no such problem. Juveniles whose first offense was for a brutal or violent nature have hazard ratios 1.5 times higher than juveniles whose first offense was not a brutal or violent offense. Juveniles with a “parent not present” have hazard ratios 1.4 times higher than juveniles with both parents. This suggests that each of these variables is a factor that increases risk of recidivism.

Only “initial age” has a coefficient with a negative value. This indicates that the higher the age when the initial offense is committed, the lower the risk of recidivism. The exponential (coefficient) value of 0.87 indicates that an increase by one year of age results in a 13% risk reduction. When age at the time of initial arrest is compared for the ages 12 and 15, risk of recidivism for juveniles aged 15 was 0.66 times (0.87 × 0.87 × 0.87) that of those aged 12.

Next, we proceed with analysis of the impact of problems adapting at school on risk of recidivism. The variable “attending * problems adapting at school” was newly added as the explanatory variable in the model for which results are shown in Table 8-4. Then, the resultant estimated values could be interpreted as follows. The variable “problems adapting at school” indicates the impact of an adaptation problem on the risk of recidivism regardless of the passage of time. The variable “attending * problems adapting at school” indicates the impact of an adaptation problem on the risk of recidivism only during the period the individual attended school. This means that whether the delinquency-promoting effect of having problems adapting at school is limited to individuals currently attending middle school can be verified (1) by comparing this model with the previous model to determine which has a higher goodness of fit, and (2) by determining whether variables “problems adapting at school” and “attending * problems adapting at school” are statistically significant.

Estimation results for the model are shown in Table 8-5.

Table 8-5. Proportional Hazard Model Estimation Results 2

Explanatory variable	Coef.	exp (coef.)	p-value
Initial age	−0.14	0.87	0.011
Brutal / violent	0.39	1.48	0.001
Parent not present	0.30	1.35	0.001
Problems with nurturing	0.40	1.49	0.000
Problems adapting at school	0.36	1.43	0.075
Attending * Problems adapting at school (Variable that varies with time)	0.18	1.20	0.479
			−2LL = 7,626.75

While the model shows hazard risk significant at the 1% level, there were almost no changes in −2LL (value derived by −2 times log likelihood). In other words, the results suggest that there is

inputting the variable "attending * problems adapting at school" is meaningless.[9]

Turning the focus to exponentials (coefficient), the variable "attending * problems adapting at school" is not significant, which shows that it was not meaningful to input this variable. In sum, regardless of time, "problems adapting at school" impacts risk of recidivism, and results suggest that the impact is not limited to the time the individual is attending middle school.

Section 4 Conclusion and Observations

A simplified summary of the analytical results is as follows.

First, results of analysis with the Kaplan–Meier method show that risk for recidivism increases when "initial age" is low, initial crime type is "brutal/violent," when a "parent is not present," when there are "problems with nurturing," or when there are "problems adapting at school."

Second, the results of using the Cox proportional hazard model to control the impact of other variables suggest that low "initial age," crime type of "brutal/violent," a "parent not present," "problems with nurturing," and "problems adapting at school" increase risk of recidivism.

Third, the impact of problems adapting at school on the risk of recidivism was not limited to individuals currently attending middle school. In other words, results suggest that, regardless of the time period, problems adapting at school at the time an individual attended middle school increases risk of recidivism.

Next, two points are discussed.

First, results suggest that a "parent not present" and a "poor nurturing attitude of the parent" increase the risk of recidivism. At the very least, findings that a parent being absent when a juvenile was first arrested while attending middle school is a major recidivism factor and is especially significant when the "popularization of delinquency" is widely accepted.

However, because this analysis simply examined the binary variable of "both parents present or not," it is impossible to distinguish if "absence of a parent" itself leads directly to risk of recidivism, or if some other element than absence itself (e.g., economic factors) increases risk of recidivism. Furthermore, another limitation to the analysis is that affection for parents, which should be considered, could not be examined due to the data source's limitations.[10]

According to Mori and Hanada (2007: 11), who discussed risk of reentry for juveniles in detention centers, "the variable of the absence of a parent did not have a significant impact on recidivism independently." They indicated the possibility that parental problems cease to be a critical factor due to the relatively high age (peaking at ages 17–18) of juveniles placed in detention centers.

From this perspective, it is possible that this chapter's analysis arrived at the result that absence of a parent and the nurturing attitude of parent(s) were linked to recidivism merely because study

---

[9] It is AIC = −2LL + 2 × (number of parameters). Because this model had one more parameter than the previous model, −2LL must decrease by 2 or more for the fitness of the model to be deemed improved, based on the AIC criteria.

[10] As indicated by Hirschi (1969), affection for parents is believed to be one important factor that inhibits delinquency. Yuma and Kanazawa (2001) and Yuma et al. (2006) have demonstrated that affection for parents impacts recidivism.

participants were middle school students at the time of initial offense. Since research about domestic conditions pertaining to recidivism factors is lacking, further consideration in combination with previous research in this way is also deemed significant.

Second, "problems adapting at school" was shown to lead to increased risk of recidivism regardless of whether the individual was currently attending middle school. While examination was conducted with additional consideration of Harada's (1991) analysis, variables input into the analytical model differed somewhat from those used in this chapter's analysis,[11] rendering simple comparisons of the results impossible. However, the results above suggest that "the type of structural pressure that directs individuals having problems adapting primarily in an academic sense toward deviant behavior" (Harada 1991:48), which was prevalent at the time only while the student was attending middle school, is no longer limited to the period of attendance, but continues even after graduation from middle school (or at least until the individual reaches adulthood). Exploring backgrounds of this change is an important topic for further research.[12]

Section 5 Summary

This chapter examined factors leading to juvenile recidivism in October 1987–September 1988 BC based on police department juvenile delinquency records. While the number of variables was restricted due to data source limitations, the author believes that these results have a high degree of general applicability and lead to conclusions with a high degree of validity.

(To be continued in the next number.)

References

Allison, P. D., 1984, *Event History Analysis: Regression for Longitudinal Event Data*, Sage.

Cox, D. R., 1972, "Regression Models and Life Tables (with Discussion)", *Journal of the Royal Statistical Society, Series B (Methodological)*, 34: 187-220.

Cox, D. R., 1975, "Partial Likelihood", *Biometrika*, 62: 269-276.

Harada, Y., 1989a, "Issues in Applying Event History Analysis to the Study of Youthful Criminal Careers", *Reports of National Research Institute of Police Science, Research on Prevention of Crime and Delinquency*, 30(1): 57-68, in Japanese.

Harada, Y., 1989b, "Recent Developments in Longitudinal Studies of Crime in the United States", *Japanese Journal of Sociological Criminology*, 14: 142-151, in Japanese.

[11] The variable of "family economic circumstances," included in Harada's (1991) analysis, could not be obtained at the time of this chapter's analysis. Conversely, while the variable of "crime type at the time of initial arrest" was not input into Harada's (1991) model, it was included in this chapter's analysis.

[12] Sampson and Laub (1993) proposed "stable employment" as one factor for abandoning crime after adolescence, and research in Japan also suggests suppression of recidivism through employment (Okada 2006). The impact of the juvenile labor market on delinquent behavior is an especially important research topic.

Harada, Y., 1991, “A Study on Delinquent Careers of the 1970 Birth Cohort (2): An Event History Analysis on the Effect of School Maladjustment”, *Reports of National Research Institute of Police Science, Research on Prevention of Crime and Delinquency*, 32(1): 38-85, in Japanese.

Harada, Y. and M. Tamura, 1990, “A Study on the Recidivism of Stimulant Drug Offenders: An Application of Survival Analysis”, *Reports of National Research Institute of Police Science, Research on Prevention of Crime and Delinquency*, 31(1): 10-19, in Japanese.

Hirschi, T., 1969, *Causes of Delinquency*. University of California Press.

Kaplan, E. L. and P. Meier, 1958, “Nonparametric Estimation from Incomplete Observations”, *Journal of the American Statistical Association*, 53: 457-481.

Kayaba, K. et al., 1986, “Shonenin Shutsuinsha no Nariyuki ni Kansuru Kenkyu (Dai 1 Hokoku) [A Study on Reoffending of Ex-inmates of Juvenile Training Schools, First Report]”, *Bulletin of the Criminological Research Department*, 29: 23-55, in Japanese.

Kayaba, K. et al., 1987, “Shonenin Shutsuinsha no Nariyuki ni Kansuru Kenkyu (Dai 2 Hokoku) [A Study on Reoffending of Ex-inmates of Juvenile Training Schools, Second Report]”, *Bulletin of the Criminological Research Department*, 30: 25-57, in Japanese.

Mantel, N., 1966, “Evaluation of Survival Data and Two New Rank Order Statistics Arising in Its Consideration”, *Cancer Chemotherapy Reports*, 50: 163-170.

Mori, T, Y. Hamaguchi, and O. Kuroda, 2004, “Predicting Reconviction of the Prison Inmate with Mental Disorder”, *The Japanese Journal of Criminal Psychology*, 42(2): 43-58, in Japanese.

Mori, T. and M. Hanada, 2007, “Analysis of Recidivism Risk of Juvenile Delinquents Released from a Juvenile Classification Home: Analysis Using Split Population Model”, *The Japanese Journal of Criminal Psychology*, 44(2): 1-14, in Japanese.

Mori, T. and H. Tsutomi, 2007, “Explaining the Age-crime Curve: Assessment of the Relative Validity of Moffitt's Hypotheses and the General Theory of Crime”, *The Japanese Journal of Criminal Psychology*, 44(2): 23-38, in Japanese.

Mugishima F. and Y. Matsumoto, 1966, “An Analysis of Adult Offenses Related to their Delinquent Careers: On the 1942 Cohort in Tokyo”, *Reports of National Research Institute of Police Science, Research on Prevention of Crime and Delinquency*, 7(2): 73-83, in Japanese.

Nagoya Family Court, 1996, “Saihan Shonen ni Kansuru Kenkyu: Shonen Jiken Shori Shisutemu Katsuyo ni Yoru Suryoteki Kenkyu to Jirei Kenkyu kara [A study on Juvenile Reoffender]”, *Katei Saiban Geppo*, 48(9): 95-163, in Japanese.

Nakai, M., 2005, “Raifu Ibento no Tokei Bunseki: Event History Analysis [Statistical Analysis on Life Events Using Event History Analysis]”, *Ritsumeikan Social Sciences Review*, 41(2): 77-85, in Japanese.

Oe, Y., N. Morita, and Y. Nakatani, 2008, “Development of a Multidimensional Typology of Juvenile Sex Offenders: Applicability to Risk Assessment of Recidivism and Treatment Planning”, *The Japanese Journal of Criminal Psychology*, 46(2): 1-13, in Japanese.

Ohashi, Y. and C. Hamada, 1995, *Seizon Jikan Kaiseki: SAS ni Yoru Seibutsu Tokei [Analysis of Survival Data : Biostatistics Using SAS Software]*, University of Tokyo Press, in Japanese.

Okabe, T., 2016, “The Quantitative Analysis of Juvenile Delinquency in Contemporary Japan (Part 1)”,

Journal of the Literary Society of Yamaguchi University, 66: 121-160.

Okabe, T., 2017, "The Quantitative Analysis of Juvenile Delinquency in Contemporary Japan (Part 2)", *Journal of the Literary Society of Yamaguchi University*, 67: 87-131.

Okada, K., 2006, "Kosei Hogo ni Okeru Shuro Shien: Hanzaisha Hiko Shonen no Shuro Jokyo wo Chushin ni Shite [The Employment Support for Ex-offenders]", *Journal of correctional issues*, 27: 59-90, in Japanese.

Okamoto, H., 2002, "Identification of Risk Factors for Adult Criminal Behaviour among Juvenile Delinquents", *Japanese Journal of Sociological Criminology*, 27: 102-112, in Japanese.

Sampson, R. J. and J. H. Laub, 1993, *Crime in the Making: Pathways and Turning Points through Life*, Harvard University Press.

Sato, N. et al., 1985, "Shonen Kanbetsusho Taisho Shonen no Nariyuki Chosa [A Study on Reoffending of Ex-inmates of Juvenile Classification Homes]", *Bulletin of the Criminological Research Department*, 28: 191-211, in Japanese.

Schmidt, P. and A. D. Witte, 1988, *Predicting Recidivism Using Survival Models*, Springer-Verlag.

Schoenfeld, D., 1982, "Partial Residuals for the Proportional Hazards Regression Model", *Biometrika*, 69(1): 239-241.

Tsutomi, H., 1991, "Event History Analysis no Nariyuki Chosa Bunseki e no Oyo: Hirei Hazard Model wo Mochiite [An Application of Event History Analysis to Study on Criminal Career], *Chuo Kenkyujo Kiyo*, 1: 55-63, in Japanese.

Watanabe, K., 2007, "10-year Follow-up Study on Violent Recidivism of 603 Homicide Offenders in 1994 : Risk Factors for Violent Recidivism and Influences of Mental Disorders, *Acta Criminologiae et Medicinae Legalis Japonica*, 76(6): 174-207, in Japanese.

Yamaguchi, K., 1987, "Event-History Analysis: Its Contributions to Modeling and Causal Inference", *Sociological theory and methods*, 2(1): 61-82.

Yamamoto, S., 2008, "Hiko Keireki Kenkyu wo Katsuyo Suru: Shonen Jiken Shori Shisutemu kara Evidence-based Practice ni Mukete [Evidence-based Practice Using Delinquent Career Data]", Kachokyo Journal, 36: 55-64, in Japanese.

Yuma, Y. and Y. Kanazawa, 2001, "Hiko Shonen ni Taisuru Kyosei Kyoiku no Koka: Shonen Kanbetsusho Nyusho Shonen no Saihan ni Taisuru Hogo Kansatsu to Shonenin Shogu no Koka [The Effects of Correctional Education on Delinquent Juveniles]", *Research-aid Paper of the Yasuda Life Welfare Foundation*, 37: 115-122, in Japanese.

Yuma, Y., Y. Kanazawa, and M. Kuniyoshi, 2006, "Effectiveness of Japanese Correctional Treatments for Juveniles", *Behaviormetrika*, 33(2): 149-177.

Yuma, Y. and F. Kashiwagi, 2007, "Evaluating Effectiveness of Recommendations by the Juvenile Classification Homes in Japan", *Bulletin of the Faculty of Human and Social Studies, Saitama Institute of Technology*, 5: 17-23, in Japanese.