

## Research article

# Development of a prediction model for child maltreatment recurrence in Japan: A historical cohort study using data from a Child Guidance Center



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## ABSTRACT

To develop a prediction model for the first recurrence of child maltreatment within the first year after the initial report, we carried out a historical cohort study using administrative data from 716 incident cases of child maltreatment (physical abuse, psychological abuse, or neglect) not receiving support services, reported between April 1, 1996 through March 31, 2011 to Shiga Central Child Guidance Center, Japan. In total, 23 items related to characteristics of the child, the maltreatment, the offender, household, and other related factors were selected as predictive variables and analyzed by multivariate logistic regression model for association with first recurrence of maltreatment. According to the stepwise selection procedure six factors were identified that include 9–13 year age of child (AOR=3.43/95%CI=1.52–7.72), <40 year age of the offender (AOR=1.65/95%CI=1.09–2.51), offender's history of maltreatment during childhood (AOR=2.56/95%CI=1.31–4.99), household financial instability or poverty (AOR=1.64/95%CI=1.10–2.45), absence of someone in the community who could watch over the child (AOR=1.68/95%CI=1.16–2.44), and the organization as the referral source (AOR=2.21/95%CI=1.24–3.93). Using these six predictors, we generated a linear prediction model with a sensitivity and specificity of 45.2% and 82.4%, respectively. The model may be useful to assess the risk of further maltreatment and help the child and family welfare administrations to develop preventive strategies for recurrence.

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**Abbreviations:** CGC, Child guidance center; AIC, Akaike's information criterion; ROC, receiver-operating characteristic; AUC, areas under the curve; SD, standard deviation; IQR, interquartile range; OR, odds ratio; 95%CI, 95% confidence interval; AOR, adjusted odds ratio.

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## 1. Introduction

Children who experience maltreatment are at increased risk of long term physical, psychological, and behavioral consequences (Berlin, Appleyard, & Dodge, 2011; Norman et al., 2012; Tanaka, Georgiades, Boyle, & MacMillan, 2015; Tanaka, Wekerle, Schmuck, & Paglia-Boak, 2011; Widom, Czaja, Bentley, & Johnson, 2012). Reports of child maltreatment have been steadily increasing since the late 1990s in Japan (Equal Employment, Children and Families Bureau, 2013a, 2015). In response, Child Abuse Prevention Law in 2000 was enacted in 2000, introducing a series of measures to prevent maltreatment and protect children who have suffered maltreatment including health support for pregnant women (Equal Employment, Children and Families Bureau, 2009); home visiting services for all parents of new infants before 4 months of age (Equal Employment, Children and Families Bureau, 2007a); strengthening of the foster parent system (Equal Employment, Children and Families Bureau, 2012); confirmation of the child's safety within 48 h after receiving a notification (Equal Employment, Children and Families Bureau, 2007b); and the partial revision of the Civil Law to restrict parental authority (Equal Employment, Children and Families Bureau, 2011). Despite all these measures, the number of child abuse consultations handled at the Child Guidance Center (CGC), the main organization that deals with child maltreatment, nationwide has not subsided. The consultations increased by 8077%, from 1101 in 1990 to 88,931 in 2014 (Equal Employment, Children and Families Bureau, 2013a, 2015), indicating that child maltreatment has become a serious social concern in Japan.

In 2008, the National Association of Child Guidance Center Directors conducted a nationwide survey on the situation of response, service provision and treatment for child maltreatment cases at the CGCs, but did not include questions about recurrence (Maruyama, 2009; National Association of Child Guidance Center Directors, 2009). Later in 2010, as part of the policy evaluation, the Ministry of Internal Affairs and Communications carried out the only survey to date, albeit not random, describing the proportion of child maltreatment recurrence as 9.5% (269/2823), 9.1% (272/2974), and 5.0% (166/3322) in 2007, 2008 and 2009, respectively (Administrative Evaluation Bureau, 2013). Unfortunately, systematic statistical data and studies with robust methodology are still lacking in Japan.

It is important to ensure that the child has a safe and an adequate environment enabling both mental and physical growth. In this regard, a thorough understanding of factors associated with maltreatment recurrence is of vital importance and very useful to guide effective preventive strategies. Studies on predictors of recurrence have been carried out in many countries, especially in the United States. However, results varied greatly probably due to differences in the study population, study design, definition and classification of maltreatment, as well as methods for data collection (Fluke & Hollinshead, 2003; Hindley, Ramchandani, & Jones, 2006; White, Hindley, & Jones, 2015). Numerous factors have been identified as predictors for maltreatment recurrence that include case characteristics of child, offender, caregiver, and family (Bae, Solomon, & Gelles, 2009; Casanueva et al., 2015; DePanfilis & Zuravin, 1999a; Dorsey, Mustillo, Farmer, & Elbogen, 2008; Drake, Jonson-Reid, & Sapokaite, 2006; English, Marshall, Brummel, & Orme, 1999; Fluke, Chabot, Fallon, MacLaurin, & Blackstock, 2010; Fluke, Shusterman, Hollinshead, & Yuan, 2008; Fluke, Yuan, & Edwards, 1999; Fryer & Miyoshi, 1994; Hélie & Bouchard, 2010; Helie, Laurier, Pineau-Villeneuve, & Royer, 2013; Putnam-Hornstein, Simon, Eastman, & Magruder, 2015; Sledjeski, Dierker, Brigham, & Breslin, 2008), agency factors and resources in community (Maguire-Jack & Font, 2014), sequence towards substantiation (Casanueva et al., 2015; Eastman, Mitchell, & Putnam-Hornstein, 2016; Putnam-Hornstein et al., 2015), and effects of service provisions after initial report (DePanfilis & Zuravin, 2002; Eastman et al., 2016; Jonson-Reid, Chung, Way, & Jolley, 2010; MacMillan et al., 2009).

Although there are common predictors identified in the literature such as young age (Bae et al., 2009; Drake et al., 2006; Fluke et al., 1999, 2008; Fryer & Miyoshi, 1994), prior reports (Bae et al., 2009; Fluke et al., 1999, 2008; Fryer & Miyoshi, 1994) and neglect (DePanfilis & Zuravin, 1999a; Drake et al., 2006; Fluke et al., 1999; Fryer & Miyoshi, 1994), because many other factors differ between studies, a universal standardized recurrence risk assessment tool does not exist (D'Andrade, Austin, & Benton, 2008; DePanfilis & Scannapieco, 1994; Gillingham, 2015; Johnson, 2011).

The Japanese government issued guidelines to assess the need for temporary protective custody (Equal Employment, Children and Families Bureau, 2013c) and there is a proposed assessment tool that is being widely used to manage support in the community (Fujiwara, Okuyama, & Ishii, 2006; Kato, 2009; Sato, 2008), but there is no standardized assessment tool that could help the CGC make an initial rapid judgment of the necessary measures to prevent the recurrence of maltreatment (Administrative Evaluation Bureau, 2013; Equal Employment, Children and Families Bureau, 2013c). Therefore, the aim of our study is to develop a multivariate model to identify children with significantly increased risk for first recurrence of child maltreatment within a year in a historical cohort study using the database of the CGC in one prefecture of Japan.

## 2. Methods

### 2.1. Data source

In Japan, the main authority responsible for child and family welfare is the CGC, who can work in cooperation with the Municipal Child Family Support Division (Equal Employment, Children and Families Bureau, 2010). The CGC manages the investigation, confirmation and initial response of reported cases of child maltreatment, and may provide services to the family or separate the child from the family. Upon notification of maltreatment, the CGC assesses the case. A multidisciplinary team, consisting of a medical doctor, child welfare officer, child psychologist, childcare instructor and childcare guidance staff work with the abused child, offender, family members and other concerned parties to take a course of action in the best

interest of the child (Equal Employment, Children and Families Bureau, 2013b). The CGC may separate a maltreated child from the offender to ensure the child's safety, but also at the request of parents or guardians.

This study is based on secondary data obtained from Shiga Central CGC. The center service area covered rural and semi-urban areas in Shiga prefecture during the period of our study. Also the estimated total and child population residing in the area of the Shiga CGCs had little variation; 1,299,046 total population and 282,534 (21.7%) child population in 1996, compared to 1,403,977 total populations and 255,472 (18.7%) child population in 2010. The database used standardized items on case attributes and assessment indicators adopted from the survey of the National Association of Child Guidance Center Directors performed in 1996 (National Association of Child Guidance Center Directors, 1997). Results of the initial investigation of suspected maltreatment cases were recorded at first in a paper-based registration form and later converted to digital format by a database manager. The database included all suspected cases of child maltreatment (physical abuse, psychological abuse, sexual abuse, and neglect) reported between April 1, 1996 and March 31, 2011 to the Shiga Central CGC, accounting for a total of 4201 cases. Although the original database included personal information such as name, address and phone number to help track the cases, they were removed from the database prior to this study except for the unique identification number associated to the case and its recurrence notification. In accordance to the Child Welfare Law and Child Maltreatment Prevention Law, only cases of children under 18 years of age are registered in this database at the first report of maltreatment. However, once the child is registered, even if s/he turns 18, the regional council at the Municipal Child Family Support Division monitors the case for a minimum duration of one year after registration and may continue until the child reaches 20. Along this time, the local CGC provides support if it is necessary.

## 2.2. Sample selection

We selected the cases of substantiated child maltreatment (physical abuse, psychological abuse, or neglect) newly reported between April 1, 1996 and March 31, 2011 that after initial assessment of the Shiga Central CGC were all kept under observation (monitoring) and had at least one-year of follow up. Fig. 1 shows in detail the selection method. We excluded cases where the initial report was after April 1, 2010 because they had less than one year of follow up by March 31, 2011, end of the study period (616 cases), and the cases of abuse or neglect that could not be substantiated (339 cases), cases where provision of service was suspended (19 cases), cases where the main form of abuse was sexual (91 cases) because the handling of these cases is substantially different from other forms of abuse or neglect; the child is immediately distanced from his/her home and placed in a temporary protection center for 2–4 weeks generally, and both the child and the family go through a series of treatment for at least a year thereafter to prevent recurrence (National Association of Child Guidance Center Directors, 2013). We also excluded cases where the child was separated from the family (278 cases), had confirmed history of previous abuse or neglect (1402 cases), or were receiving any medical, psychological, or clinical social support (740 cases). Cases receiving any support were excluded because no recurrence is to be recorded during support period even if it happened. Inclusion of these cases therefore results in an underestimation of the rate of recurrence.

## 2.3. Variables

**2.3.1. Study outcome: child maltreatment first recurrence.** In our study, child maltreatment first recurrence was defined as a first substantiated report of maltreatment including physical abuse, psychological abuse, sexual abuse or neglect that occurred within 1 year from a prior substantiation involving the same child.

Shiga Central CGC used definitions of physical abuse, psychological abuse, sexual abuse and neglect as considered in the Child Welfare Law. Child maltreatment constituted an event happening inside the family or an act by any of the family members. Physical abuse included the acts of hitting, kicking, throwing and shaking, burning, drowning, or strangling. Psychological abuse included verbal threatening, ignoring, discriminatory treatment between brother and sisters, or witnessing domestic violence. Sexual abuse included involving a child in sexual acts, witnessing any sexual activities, touching a child's sex organs, guiding a child to touch any sex organs, or subjecting a child to pornography. It was considered neglect when there was no parental caregiving or there was disregard for the child such as not providing enough meals, keeping a filthy and dangerous house environment, not providing healthy daily routine, not taking the child to the hospital even in case of a serious illness, or leaving the child unattended in a car.

**2.3.2. Independent variables.** Based on standardized items on case attributes and assessment indicators adopted from the survey of the National Association of Child Guidance Center Directors performed in 1996 and previous studies of historical cohort design (Bae, Solomon, & Gelles, 2007; Bae et al., 2009; Sledjeski et al., 2008; Wolock & Magura, 1996), we selected 23 items as independent (predicting) variables and explored their association with maltreatment recurrence. These variables are common between the standardized items used in Japan and those in international literature except for the variables "presence of community member(s) who could watch over the maltreated child" and "neighbor as referral source" that are unique and important in Japan's social context. The items included were: (1) type of the maltreatment (Bae et al., 2009; Fryer & Miyoshi, 1994; Sledjeski et al., 2008) and frequency (English et al., 1999); (2) child characteristics such as gender (Fluke et al., 2008; Jonson-Reid, Drake, Chung, & Way, 2003; Sledjeski et al., 2008), age (Fluke et al., 1999; Helie et al., 2013), medically diagnosed symptoms at the time of registration (Sledjeski et al., 2008), mental or physical disability (Bae et al., 2009; DePanfilis & Zuravin, 1999b; Drake et al., 2006; Sledjeski et al., 2008), emotional or behavioral problems (Drake et al.,

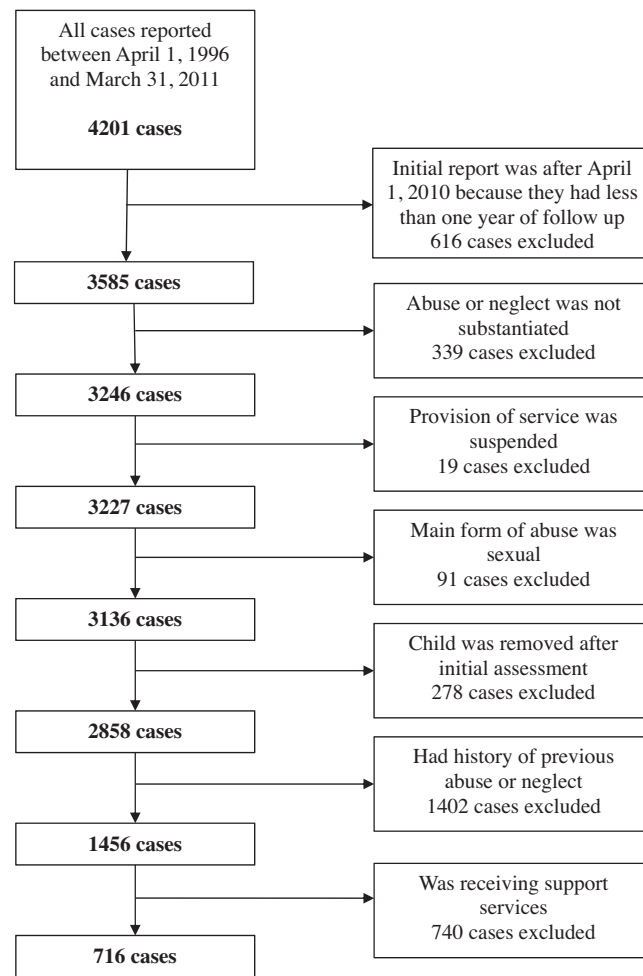


Fig. 1. Flow diagram of cases included and excluded from our study.

2006), reactive emotional instability (Sledjeski et al., 2008), and other upbringing problems (Drake et al., 2006); (3) items regarding the offender such as main offender (Jonson-Reid et al., 2003; Sledjeski et al., 2008) and offender's age (Dorsey et al., 2008), disability (Barth, Gibbons, & Guo, 2006; Sledjeski et al., 2008; Wolock & Magura, 1996), history of maltreatment during childhood (Dorsey et al., 2008; English et al., 1999; Wolock & Magura, 1996), whether or not the offender lived with the victimized child (Sledjeski et al., 2008), and willingness to cooperate with the CGC (Sledjeski et al., 2008); (4) household characteristics such as number of family members (Bae et al., 2007, 2009), siblings with history of maltreatment (Eastman et al., 2016; Putnam-Hornstein et al., 2015), presence of an adult family member who could protect the maltreated child from the offender (Sledjeski et al., 2008), financial instability or poverty (Barth et al., 2006; Wolock & Magura, 1996), and family discord or domestic violence (Dorsey et al., 2008; Sledjeski et al., 2008); and (5) other relevant items such as the presence of someone in the community (relatives, neighbors or volunteers) who could watch over and stay informed about the maltreated child (Wolock & Magura, 1996), previous welfare consultation to the CGC (Fluke et al., 2008), and referral source such as individual or organization (Bae et al., 2007, 2009), neighbors, and the maltreated child or his/her family. Disability of offenders included mental disorders, intellectual disability, physical problems, substance abuse or other problems. All these independent variables were collected at the initial registration and do not reflect any change that may have occurred after registration.

#### 2.4. Statistical analyses

We conducted a historical cohort analysis of child maltreatment incident cases and first recurrence within one year of follow up. Since maltreatment is a phenomenon occurring in the household, some studies have used the household as a unit for data analysis (Bae et al., 2007, 2009; Murphy, Bishop, Jellinek, Quinn, & Poitras, 1992; Sledjeski et al., 2008). However,

in this study the unit of analysis was the individual; in other words, “a child that was subjected to maltreatment”, as used in other studies (Fluke et al., 1999; Inkelas & Halfon, 1997).

We assessed the association between the predictive variables and maltreatment recurrence in a binary logistic analysis and reported the crude odds ratios and *p* values. Predictive variables with *p* values < 0.1 were entered into the multiple regression model simultaneously, stepwise, and using backward elimination procedures. There was no evidence of multicollinearity following the diagnostic procedures; inter-correlation coefficient with any of other variable was less than 0.45. We compared the models fit using Akaike's Information Criterion (Akaike, 1973) and the Hosmer–Lemeshow test. After selecting the most appropriate model variables, we estimated the regression coefficients using bootstrapping (1000 times of simple random sampling) and evaluated the stability of each regression coefficient using DfBeta as suggested by Pregibon (Pregibon, 1981). We rounded the regression coefficients from the stepwise model to the nearest integer and multiplied by 10 to generate a simplified prediction model (Hasan et al., 2010). Then, we computed the Receiver-Operating Characteristic (ROC) curves and the area under the curve (AUC) to compare this simplified model to the original regression models. A *p* value of < 0.05 was considered statistically significant. Finally, we calculated sensitivity and specificity at various cut-off points to examine practical applicability of the prediction model.

### 3. Results

Overall, we selected 716 cases. All were of Japanese nationality. Tables 1 and 2 show the descriptive statistics of maltreatment cases and results of the bivariate logistic regression analyses. The age at initial report ranged from 0 to 17, with an average age of 7.1 years (SD = 4.6) and median of 7 years (IQR: 3–11) (not shown in the table). Among all cases, the main forms of maltreatment at the initial report were physical abuse (303 cases, 42.3%) and neglect (299 cases, 41.8%). A quarter of all cases (177 cases, 24.7%) experienced a recurrence of maltreatment within 1 year of follow up. Regarding the time of recurrence, 12.4% (22 cases) occurred in 30 days or less after registration, 48.6% (86 cases) between 31 days to 180 days, and 39.0% (69 cases) between 181 days to 365 days (not shown in the table). In most cases (638 cases, 89.1%) the main offender was a biological parent, and in only 6.8% (49 cases) and 4.1% (29 cases) the main offender was a stepparent and a guardian, respectively (not shown in the table). Those who reported frequent initial maltreatment were significantly more likely (odds ratio (OR) = 1.62/95% confidence interval (CI) = 1.12–2.35) to experience recurrence. Also, when the offender was under age 40 (OR = 1.82/95%CI = 1.24–2.68), had a disability (OR = 1.61/95%CI = 1.14–2.27) or history of maltreatment during his/her childhood (OR = 2.99/95%CI = 1.59–5.63) maltreatment was more likely to recur. Other factors significantly associated with recurrence of maltreatment were: financial instability or poverty (OR = 1.89/95%CI = 1.29–2.77), absence of an adult family member who could protect the child (OR = 1.47/95%CI = 1.03–2.11), absence of a community member who could watch over the child (OR = 1.51/95%CI = 1.07–2.14), and having a history of consultation with CGC (OR = 1.63/95%CI = 1.05–2.53). In our sample there were no multiple concurrent cases of child maltreatment in the same household. However, 14.5% (104 cases) reported siblings with history of maltreatment.

Table 3 shows the results of multiple logistic regression analysis using a stepwise approach. Our study revealed that six items were significantly associated with maltreatment recurrence: 9–13 year age of child (AOR = 3.43/95%CI = 1.52–7.72), < 40 years age of the offender (AOR = 1.65/95%CI = 1.09–2.51), history of maltreatment during offender's childhood (AOR = 2.56/95%CI = 1.31–4.99), financial instability or poverty (AOR = 1.64/95%CI = 1.10–2.45), absence of someone in the community who could watch over the child (AOR = 1.68/95%CI = 1.16–2.44), and the official organization as referral source (AOR = 2.21/95%CI = 1.24–3.93). This multiple logistic regression model was statistically significant (model chi square = 62.91, *p* < 0.001) and showed sufficient fit to the actual values (–2 log likelihood = 737.93, AIC = 755.93 and *p* value of the Hosmer–Lemeshow test = 0.71). Almost identical results were obtained for the model developed by the backward elimination procedure (data not shown). Precision of the regression coefficients of the stepwise entry model were further estimated using bootstrapping with results quite similar with those in Table 3 (data not shown), validating the stabilities of the regression coefficients of the model. The stability of the prediction model was also evaluated using DfBeta, which ranged between –0.023 and 0.064, showing that there is no single case exerting a large influence on the model. To evaluate the effect of possible changes in the procedures for notification, investigation and services over the 15 years, we applied the same multivariate analytical procedure separately among the cases reported between April 1, 1996 to March 31, 2005 and those between April 1, 2005–March 31, 2010, confirming that the same set of the variables were associated with the maltreatment recurrence to almost the same extent (not shown in the tables).

The far right column of Table 3 shows the scores for our prediction model consisted of six factors: child age, offender's age, history of abuse or neglect during offender's childhood, financial instability or poverty of the household, presence of someone in the community who can watch over the victim, and referral source. The AUC of the prediction model was 0.66 (95%CI: 0.61–0.70), similar to the AUC of the stepwise entry model (0.69; 95%CI: 0.64–0.73).

When comparing the prediction scores computed by the prediction model and the observed proportion of maltreatment recurrence, the maximum discrimination between maltreatment recurrence and non-recurrence was attained at the score of 20. According to the model, the estimated risks of recurrence at score 0–9, 10–20 and 21–28, and 29–44 were 11.7%, 21.8%, 37.7%, and 43.8% respectively (Table 4). When cutoff was set at scores 9, 20 or 28, sensitivity and specificity were 93.8% and 17.4%; 45.2% and 82.4%; and 7.9% and 94.1%, respectively (Data not shown).

**Table 1**

Bivariate association of child and household's selected predictive variables with first maltreatment recurrence within 1 year.

| Predictive Variables                                                      | Number of Cases | Recurrence Cases |        | Crude Odds Ratio | 95% Confidence Interval |       | p value |
|---------------------------------------------------------------------------|-----------------|------------------|--------|------------------|-------------------------|-------|---------|
|                                                                           |                 | N                | (%)    |                  | Lower                   | Upper |         |
| Child characteristics                                                     |                 |                  |        |                  |                         |       |         |
| Gender                                                                    |                 |                  |        |                  |                         |       |         |
| Male                                                                      | 368             | 87               | (23.6) | reference        |                         |       |         |
| Female                                                                    | 348             | 90               | (25.9) | 1.13             | 0.80                    | 1.58  | 0.49    |
| Age (years)                                                               |                 |                  |        |                  |                         |       |         |
| 0–4                                                                       | 247             | 62               | (25.1) | 2.76             | 1.26                    | 6.08  | 0.01    |
| 5–8                                                                       | 190             | 43               | (22.6) | 2.41             | 1.08                    | 5.42  | 0.03    |
| 9–13                                                                      | 205             | 64               | (31.2) | 3.74             | 1.70                    | 8.26  | <0.001  |
| 14–17                                                                     | 74              | 8                | (10.8) | reference        |                         |       |         |
| Number of medically diagnosed symptoms                                    |                 |                  |        |                  |                         |       |         |
| 0                                                                         | 225             | 45               | (20.0) | reference        |                         |       |         |
| 1                                                                         | 387             | 99               | (25.6) | 1.37             | 0.92                    | 2.05  | 0.12    |
| 2 or more                                                                 | 104             | 33               | (31.7) | 1.86             | 1.10                    | 3.15  | 0.02    |
| Mental or physical disability                                             |                 |                  |        |                  |                         |       |         |
| Yes                                                                       | 70              | 18               | (25.7) | 1.06             | 0.60                    | 1.87  | 0.84    |
| No                                                                        | 646             | 159              | (24.6) | reference        |                         |       |         |
| Emotional or behavioral problems                                          |                 |                  |        |                  |                         |       |         |
| Yes                                                                       | 56              | 18               | (32.1) | 1.49             | 0.83                    | 2.69  | 0.18    |
| No                                                                        | 660             | 159              | (24.1) | reference        |                         |       |         |
| Reactive emotional instability                                            |                 |                  |        |                  |                         |       |         |
| Yes                                                                       | 656             | 158              | (24.1) | reference        |                         |       |         |
| No                                                                        | 60              | 19               | (31.7) | 1.49             | 0.83                    | 2.69  | 0.18    |
| Other upbringing problems                                                 |                 |                  |        |                  |                         |       |         |
| Yes                                                                       | 162             | 42               | (25.9) | 0.92             | 0.62                    | 1.38  | 0.69    |
| No                                                                        | 554             | 135              | (24.4) | reference        |                         |       |         |
| Household characteristics                                                 |                 |                  |        |                  |                         |       |         |
| Number of family members                                                  |                 |                  |        |                  |                         |       |         |
| 2                                                                         | 53              | 16               | (30.2) | 1.57             | 0.75                    | 3.29  | 0.23    |
| 3                                                                         | 238             | 63               | (26.5) | 1.30             | 0.76                    | 2.23  | 0.33    |
| 4                                                                         | 314             | 74               | (23.6) | 1.12             | 0.66                    | 1.88  | 0.68    |
| 5 or more                                                                 | 111             | 24               | (21.6) | reference        |                         |       |         |
| Sibling(s) with history of maltreatment                                   |                 |                  |        |                  |                         |       |         |
| Yes                                                                       | 104             | 33               | (31.7) | 1.86             | 1.10                    | 3.15  | 0.02    |
| No                                                                        | 387             | 99               | (25.6) | 1.37             | 0.92                    | 2.05  | 0.12    |
| Undetermined                                                              | 225             | 45               | (20.0) | reference        |                         |       |         |
| Presence of an adult family member who could protect the maltreated child |                 |                  |        |                  |                         |       |         |
| Yes                                                                       | 495             | 111              | (22.4) | reference        |                         |       |         |
| No                                                                        | 221             | 66               | (29.9) | 1.47             | 1.03                    | 2.11  | 0.03    |
| Financial instability or poverty                                          |                 |                  |        |                  |                         |       |         |
| Yes                                                                       | 162             | 56               | (34.6) | 1.89             | 1.29                    | 2.77  | <0.001  |
| No                                                                        | 554             | 121              | (21.8) | reference        |                         |       |         |
| Family discord or domestic violence                                       |                 |                  |        |                  |                         |       |         |
| Yes                                                                       | 110             | 27               | (24.5) | 0.99             | 0.62                    | 1.59  | 0.96    |
| No                                                                        | 606             | 150              | (24.8) | reference        |                         |       |         |

CGC: Child Guidance Center.

#### 4. Discussion

Although the importance of having an assessment tool to determine if a child is at risk for maltreatment recurrence has been previously claimed by child health, education, forensic, and welfare practitioners in Japan ([Administrative Evaluation Bureau, 2013](#); [Equal Employment, Children and Families Bureau, 2013c, 2014](#)), to the best of our knowledge, this is the first study in Japan to develop a practical prediction model assessing child maltreatment first recurrence within 1 year after initial report. Our study identified six variables as significant predictors of maltreatment recurrence. These included being a child aged 9–13 years, less than 40 years age of the offender, history of maltreatment during offender's childhood, financial instability or poverty, absence of someone in the community who could watch over the child, and the official organization as referral source. The simple linear prediction model developed from this analysis was demonstrated to enable the monitoring of the unsupported cases with weighted caution according to the probability of maltreatment recurrence. This

**Table 2**

Bivariate association of offender, maltreatment at initial report and other selected predictive variables with first maltreatment recurrence within 1 year.

| Predictive Variables                                                      | Number of Cases | Recurrence Cases |        | Crude Odds Ratio | 95% Confidence Interval |       | p value |
|---------------------------------------------------------------------------|-----------------|------------------|--------|------------------|-------------------------|-------|---------|
|                                                                           |                 | N                | (%)    |                  | Lower                   | Upper |         |
| Offender                                                                  |                 |                  |        |                  |                         |       |         |
| Main offender                                                             |                 |                  |        |                  |                         |       |         |
| Father (biological, foster, or stepfather)                                | 226             | 56               | (24.8) | 1.04             | 0.42                    | 2.55  | 0.94    |
| Mother (biological, foster, or stepmother)                                | 461             | 114              | (24.7) | 1.03             | 0.43                    | 2.48  | 0.94    |
| Other (grandparent, relative or sibling)                                  | 29              | 7                | (24.1) | reference        |                         |       |         |
| Offender's age                                                            |                 |                  |        |                  |                         |       |         |
| <40                                                                       | 474             | 134              | (28.3) | 1.82             | 1.24                    | 2.68  | <0.001  |
| 40 or more                                                                | 242             | 43               | (17.8) | reference        |                         |       |         |
| Disability of the offender                                                |                 |                  |        |                  |                         |       |         |
| Yes                                                                       | 361             | 105              | (29.1) | 1.61             | 1.14                    | 2.27  | 0.01    |
| No                                                                        | 355             | 72               | (20.3) | reference        |                         |       |         |
| History of maltreatment during childhood                                  |                 |                  |        |                  |                         |       |         |
| Yes                                                                       | 42              | 20               | (47.6) | 2.99             | 1.59                    | 5.63  | <0.001  |
| No                                                                        | 674             | 157              | (23.3) | reference        |                         |       |         |
| Living with the maltreated child                                          |                 |                  |        |                  |                         |       |         |
| Yes                                                                       | 620             | 160              | (25.8) | 1.62             | 0.93                    | 2.81  | 0.09    |
| No                                                                        | 96              | 17               | (17.7) | reference        |                         |       |         |
| Willing to cooperate with the CGC                                         |                 |                  |        |                  |                         |       |         |
| Yes                                                                       | 647             | 158              | (24.4) | reference        |                         |       |         |
| No                                                                        | 69              | 19               | (27.5) | 1.18             | 0.67                    | 2.05  | 0.57    |
| Maltreatment at initial report                                            |                 |                  |        |                  |                         |       |         |
| Main type of maltreatment                                                 |                 |                  |        |                  |                         |       |         |
| Neglect                                                                   | 299             | 82               | (27.4) | 1.28             | 0.77                    | 2.12  | 0.34    |
| Physical abuse                                                            | 303             | 69               | (22.8) | 1.00             | 0.60                    | 1.67  | 0.99    |
| Psychological abuse                                                       | 114             | 26               | (22.8) | reference        |                         |       |         |
| Frequency                                                                 |                 |                  |        |                  |                         |       |         |
| Frequent                                                                  | 186             | 59               | (31.7) | 1.62             | 1.12                    | 2.35  | 0.01    |
| Occasional                                                                | 530             | 118              | (22.3) | reference        |                         |       |         |
| Other                                                                     |                 |                  |        |                  |                         |       |         |
| Presence of community member(s) who could watch over the maltreated child |                 |                  |        |                  |                         |       |         |
| Yes                                                                       | 338             | 70               | (20.7) | reference        |                         |       |         |
| No                                                                        | 378             | 107              | (28.3) | 1.51             | 1.07                    | 2.14  | 0.02    |
| History of consultation with CGC                                          |                 |                  |        |                  |                         |       |         |
| Yes                                                                       | 109             | 36               | (33.0) | 1.63             | 1.05                    | 2.53  | 0.03    |
| No                                                                        | 607             | 141              | (23.2) | reference        |                         |       |         |
| Referral source                                                           |                 |                  |        |                  |                         |       |         |
| Maltreated child or his/her family                                        | 102             | 19               | (18.6) | reference        |                         |       |         |
| Neighborhood                                                              | 329             | 63               | (19.1) | 1.03             | 0.59                    | 1.83  | 0.91    |
| Official organization                                                     | 285             | 95               | (33.3) | 2.18             | 1.25                    | 3.81  | 0.01    |

CGC: Child Guidance Center.

is a significant progress in the prediction of maltreatment recurrent among unsupported cases which used to be judged only empirically by factors such as past maltreatment history, intervention history by protective agencies, guardian's unawareness of maltreatment, and guardian's mental instability or other mental issues (Equal Employment, Children and Families Bureau, 2013c) and by the individualized assessments of the child, the guardian, and the their living conditions (Administrative Evaluation Bureau, 2013).

Unlike Japan, other countries (Cash, 2001; Coohy, Johnson, Renner, & Easton, 2013; D'Andrade et al., 2008; Gillingham, 2015) have developed assessment tools for maltreatment recurrence. However even though previous studies of cohort design on child maltreatment recurrence were focused, they were heterogeneous in children characteristics, definition and classification of maltreatment, risk factors, follow-up procedures, as well as data analyses methods (Fluke & Hollinshead, 2003; Hindley et al., 2006; White et al., 2015). Low child age has been suggested as a risk factor for recurrence (Fluke et al., 1999; Fryer & Miyoshi, 1994), but the other studies argued that there are more complicated mechanisms beneath the effect of child age on recurrence (Helie et al., 2013; Palusci, 2011). In our study, children between 9 and 13 years of age rather than younger age group were the most likely to experience recurrence. This suggests that more studies are needed in order to unveil the effect of age on recurrence of maltreatment in Japan and other settings. Previous studies have found that having a history of maltreatment or prior involvement with child protection services had higher probability of recurrence (English et al., 1999; Sledjeski et al., 2008). In our study, history of maltreatment during the offender's childhood was the second

**Table 3**

Multivariate logistic regression model using the stepwise method and scores for the prediction model.

| Predictive Variables                                                      | Regression Coefficient | Adjusted Odds Ratio | 95% Confidence Interval |       | p value | Prediction Model Scores <sup>a</sup> |
|---------------------------------------------------------------------------|------------------------|---------------------|-------------------------|-------|---------|--------------------------------------|
|                                                                           |                        |                     | Lower                   | Upper |         |                                      |
| Child characteristics                                                     |                        |                     |                         |       |         |                                      |
| Age (years)                                                               |                        |                     |                         |       |         |                                      |
| 0–4                                                                       | 0.63                   | 1.88                | 0.82                    | 4.28  | 0.13    | 6                                    |
| 5–8                                                                       | 0.62                   | 1.85                | 0.80                    | 4.29  | 0.15    | 6                                    |
| 9–13                                                                      | 1.23                   | 3.43                | 1.52                    | 7.72  | <0.001  | 12                                   |
| 14–17                                                                     |                        | reference           |                         |       |         | 0                                    |
| Offender                                                                  |                        |                     |                         |       |         |                                      |
| Offender's age                                                            |                        |                     |                         |       |         |                                      |
| <40                                                                       | 0.50                   | 1.65                | 1.09                    | 2.51  | 0.02    | 5                                    |
| 40 or more                                                                |                        | reference           |                         |       |         | 0                                    |
| History of maltreatment during childhood                                  |                        |                     |                         |       |         |                                      |
| Yes                                                                       | 0.94                   | 2.56                | 1.31                    | 4.99  | 0.01    | 9                                    |
| No                                                                        |                        | reference           |                         |       |         | 0                                    |
| Household characteristics                                                 |                        |                     |                         |       |         |                                      |
| Financial instability or poverty                                          |                        |                     |                         |       |         |                                      |
| Yes                                                                       | 0.50                   | 1.64                | 1.10                    | 2.45  | 0.02    | 5                                    |
| No                                                                        |                        | reference           |                         |       |         | 0                                    |
| Other                                                                     |                        |                     |                         |       |         |                                      |
| Presence of community member(s) who could watch over the maltreated child |                        |                     |                         |       |         |                                      |
| Yes                                                                       |                        | reference           |                         |       |         | 0                                    |
| No                                                                        | 0.52                   | 1.68                | 1.16                    | 2.44  | 0.01    | 5                                    |
| Referral source                                                           |                        |                     |                         |       |         |                                      |
| Maltreated child or his/her family                                        |                        | reference           |                         |       |         | 0                                    |
| Neighborhood                                                              | 0.03                   | 1.03                | 0.57                    | 1.87  | 0.93    | 0                                    |
| Official organization                                                     | 0.79                   | 2.21                | 1.24                    | 3.93  | 0.01    | 8                                    |

<sup>a</sup> Prediction model scores were calculated multiplying the regression coefficients by 10 and rounding to the nearest integer.**Table 4**

Comparison of the prediction model scores and the observed proportion of maltreatment recurrent cases.

|                                                                        | Prediction Model Scores <sup>a</sup> |       |       |       |
|------------------------------------------------------------------------|--------------------------------------|-------|-------|-------|
|                                                                        | 0–9                                  | 10–20 | 21–28 | 29–44 |
| Number of cases in the score range (n = 716)                           | 94                                   | 444   | 146   | 32    |
| Proportion of cases in the score range                                 | 13.1%                                | 62.0% | 20.4% | 4.5%  |
| Proportion of cases with recurrence of maltreatment in the score range | 11.7%                                | 21.8% | 37.7% | 43.8% |

<sup>a</sup> Prediction model scores were calculated multiplying the regression coefficients by 10 and rounding to the nearest integer.

strongest predictor of child maltreatment recurrence, but history of consultation with the CGC was not a predictor in the multivariate model. The fact that we excluded cases with prior reports of child maltreatment could explain this difference. Other studies have suggested family discord or domestic violence (English et al., 1999; Sledjeski et al., 2008); offender with physical or mental disability (Marshall & English, 1999; Wood, 1997); and neglect as risk factors (DePanfilis & Zuravin, 1999b; Fluke et al., 1999; Wood, 1997). One study found that the highest risk of subsequent maltreatment was within 30 days after the initial report (DePanfilis & Zuravin, 1999a). In our study, however, family discord or domestic violence, and neglect were not associated with recurrence after one year of the initial report; offender's disability was associated with recurrence but was not statistically significant in the multivariate model; and there was no tendency of recurrence to concentrate within 30 days of the initial report. All these suggest that the risk factors for maltreatment recurrence may be different between Japan and other countries, and therefore suggests a need for a tailored prediction model.

Our model, framed by a cumulative approach and an ecological approach to risk factors (Eastman et al., 2016; Maguire-Jack & Font, 2014), provides an indication of the degree of risk for recurrence and can provide an estimate on the amount of follow-up needed. Scores may be utilized in the following way: (1) scores between 9 and 19 considered as "low risk case", requiring cautious observation; (2) scores between 20 and 27 considered as "medium risk case", where implementation of preventive measures are put in place; and (3) scores of 28 or more considered as "high risk case", indicating the need for guided intervention and continuous support. If the cases are classified according to these categories, it could help limited human resource to be allocated in an efficiently and effective way. We can select different cut-off points depending on the purpose of prediction.

In our model three out of the six predictive variables are "static variables". The age of the child, age of the offender, and referral source are often identified at the initial notification of maltreatment with acceptable accuracy. For example, if the case is an adolescent between 9 and 13 years of age, the offender is under 40, and referred by a public organization, then

the predictive model score of 25 can be categorized as a case in need for guided intervention, continuous support, and to promptly start planning the necessary course of actions. On the other hand, the other 3 variables (history of maltreatment during childhood of offender, household with financial instability or poverty, and presence of someone in the community who could watch over the victim) are “intervenable variables”, the status of which can change in the follow-up support program. Even though the history of abuse or neglect in the offender's childhood is a fixed fact at the time of investigation, the mental status of the offender can be improved through appropriate care or psychological support, which may in turn change the attitude of offender to the victim. Also, the economic status of the household can change if the family is found eligible for public assistant programs. Finally, reaching out to the community can find a person who would be willing to stay informed about the child. Thus, fixed factors should be used as the basic information, and intervenable factors as supporting targets and indicators, so that recurrence preventive measures can be planned out efficiently. In addition, information about the score and predictive factors should be shared among related agencies such as the Municipal Child Family Support Divisions, the CGCs, and other agencies supporting the daily life of families to create preventive education programs; increase awareness of child abuse in the community; enhance child watch systems; formulate policy-based support; and develop an effective and viable intervention system. Ultimately, the joint efforts may promote public measures that are child-centered, community-based and solution-focused.

We recognize there are some limitations to our study that should be considered. First, due to lack of established scales many variables in the model depended on the subjective judgment of whoever did the investigation. Also, because staff involved in maltreatment cases is normally overstretched many items were assessed and recorded as a dichotomous data, limiting the power of statistical analyses. Second, our results may not be applicable to other CGC as our model is based on data from a single CGC. But, the items registered in our database were based in the 1996 nationwide survey of the National Association of Child Guidance Center Directors. Our prediction model is potentially applicable to other similar facilities, but recurrence risk factors may vary between regions. Our model is of course not applicable to other international settings; in this regard, it should be noted that potential reason for the possible difference of predictor variables between our study and those in other countries may include the fact that numerous exclusion criteria were applied to the current samples, especially the children with substantiated sexual abuse that are usually included in this kind of studies and the fact that many important predictors of recurrence such as caregiver's mental health, substance abuse and criminality were not available in this study. The third limitation is inherent to the research design of its observational and historical nature. Although not the consequence of the recurrence, independent variables are not necessary causal factors for the recurrence. In addition the predictive power of our model may vary if associations between maltreatment recurrence and predictive variables change over time or if new factors emerge. Although within our study period associations between maltreatment recurrence and predictive variables was unlikely much changed because multivariate analyses conducted separately among the cases registered early and latter half of the study periods yielded the same result, the validity of our model requires continuous verification.

In conclusion, it is essential to reduce the risk of future harm among children by assessing the risk of recurrence at the initial response and adopting the necessary countermeasures. We developed the first multivariate prediction model in Japan for child maltreatment first recurrence within one year among unsupported cases using only six items. Despite many limitations, our predictive model may be useful for child welfare organizations at least in part to assess the potential risk of maltreatment recurrence and the needs for preventive measures among unsupported cases who are otherwise left just unsupported.

### **Ethics approval and consent to participate**

The study protocol was reviewed and approved by the Ethics Committee of Kyoto University Graduate School and Faculty of Medicine (No. E1337). We also fully explained the purpose of our study, a description of the procedures, and dissemination plan of the results to officials at Shiga Central CGC; and obtained written consent from the Director. Before our study team gained access to the database, staff at the CGC removed all personal identifiers from the cases. Given the retrospective nature of our study, formal consent from the cases was not required.

### **Availability of data and materials**

The data supporting the conclusion of this article is not included within the article, because the authors are not supposed to share the dataset due to restrictions in Shiga Prefecture Personal Data Protection Regulation.

### **Competing interests**

HH worked at Shiga Central CGC until March 2012. However, all authors declare that they have no competing interests.

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## Author contributions

HH, SPS, MOK and MK discussed and conceived the study design. HH obtained the approval to use the dataset from Shiga Central CGC and carried out the statistical analyses, closely supervised by all co-authors. HH and MK wrote the first draft of this manuscript. All authors participated in the revision of the manuscript and approved the final version.

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