

## **Early assessment of the risk of child welfare involvement for preventive purposes**

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**Abstract (mag 250, nu 251)**

*Background:* Prevention of child welfare involvement through timely referral of children/families to preventive interventions is an important political aim in the Netherlands. For this purpose it is essential to early assess the risk of future child welfare involvement in families in the community.

*Objective:* To identify demographic, socio-economic and criminal history factors prospectively associated with child welfare involvement and to examine whether child welfare involvement can be predicted based on these variables.

*Participants and Setting:* Data was retrieved from the Dutch Central Bureau of Statistics from 131,532 children and their parents.

*Methods.* AUC values were calculated to examine the predictive value of factors in predicting future child welfare involvement. CHAID analysis was used to develop a risk classification using a split-sample validation method.

*Results.* An accumulation of risk factors proved to be highly predictive for child welfare involvement in the year following the assessment of the risk factors. The risk increased exponentially with an increase in the number of risk factors: when four or more risk factors were present, the risk was 10 times higher, and when six or more risk factors were present, the risk was 21 times higher than when no risk factors were present. The risk classification showed that in addition to an accumulation of risk factors, the prevalence of certain specific risk factors led to an increased risk, such as previous delinquent behavior of the parent(s) or the child.

*Conclusions.* Both the risk classification and the accumulation of risk factors can facilitate appropriate implementation of preventive interventions.

*Keywords:* Early risk assessment, accumulation of risk factors, prevention, predictive validity, child welfare involvement, child maltreatment, out-of-home placement, supervision orders, foster care

**Early assessment of the risk of child welfare involvement for preventive purposes**

The child welfare system in the Netherlands has grown over the years into a large and fragmented system, whose costs have risen considerably. This increase in costs is due to an increase in the total number of children in the child welfare system (from 380,100 in 2015 to 428,000 in 2018) and to an increase in the number of out-of-home placements (the most expensive form of youth care; from 40,505 in 2015 to 42,655 in 2017; CBS, 2019). This development takes place simultaneously with a multi-year cut in the child welfare system and the transfer of governmental tasks to municipalities.

Prevention of child welfare involvement through timely referral of children and/or families to preventive interventions is therefore an important political aim in the Netherlands. For this purpose it is essential to early assess the risk of future child welfare involvement, so that preventive interventions can be deployed and escalation of problems can be prevented. To determine which families should be referred to preventive interventions, it is important to have insight into the risk of families of future child welfare involvement. No tool is currently available to estimate this risk and therefore the aim of the current study was to investigate whether a risk assessment tool could be developed with sufficiently predictive validity that can be used to early estimate the risk of future child welfare involvement for preventive purposes.

. Child welfare involvement, such as supervision orders and out-of-home placement, is often indicated if there is an problematic child-rearing situation, caused by an imbalance between the developmental needs of children and the parenting capacities of parents. The emergence of an problematic child-rearing situation, and the resulting need for child welfare involvement, is often explained by Belsky's theoretical model (1980), who based his theory on Bronfenbrenner's (1979) ecological perspective on child development. This model emphasizes that a problematic child rearing situation is influenced by the interplay of risk and protective factors at four different levels: (1) aspects of the history of each parent that is brought into the parenting role; (2) characteristics of the family and the child; (3) characteristics of the community, degree of social support, and parental

employment; and (4) the attitude of society towards children, parenting and maltreatment. A problematic child-rearing situation is determined by the balance between risk and protective factors, and is often the result of a combination and accumulation of risk factors in various areas (see for example Brown, Cohen, Johnson, & Salzinger, 1998; Van der Put, Hermanns, Van Rijn-Van Gelderen, & Sondeijker, 2016). Because these risk factors come in many different forms, there are many different pathways leading to the need for child welfare involvement according to this model .

Risk factors most strongly related to problematic child-rearing situations include mental health problems of parents, problematic alcohol/drug use by parents, problems between parents (such as marital conflicts), parents who have been a victim of abuse during their childhood (intergenerational transfer of abuse), antisocial and delinquent behavior of parents, and stress experienced by parents (Assink e.a., 2018, 2019; Mulder e.a., 2018; Stith e.a., 2009). In addition, there are many risk factors that are less closely or even weakly associated with problematic child-rearing situations, but do play an important role in the accumulation of risk factors (see among others, Brown, Cohen, Johnson, & Salzinger, 1998), including demographic and socio-economic factors such as a child having young parents, a child not living with two biological parents, a large family size, and a low educational level of parent(s). Measuring these factors is especially important in an instrument for assessing risks in the families in the community (general population), i.e. before there are (serious) concerns about the child-rearing situation. Moreover, these factors can be measured in the general population without requiring clinical expertise, which is important in an early preventive approach.

As far as we know, no instruments are available to assess the risk of future problematic child-rearing situations in the general population. Instrument that are available for assessing the risk of problematic child-rearing situations are generally aimed at assessing the risk of *recurrence* in families under the supervision of child welfare (see for example Van der Put e.a., 2017). Instruments aimed at assessing *the onset* of problematic child-rearing situations are much less available and the

tools that are available are usually targeted at specific groups, such as mothers with newborn babies. Moreover, the development and validation of such instruments is still in its infancy worldwide (Gambrill & Shlonsky, 2000; Van der Put et al., 2017). The current study therefore examined the predictive value of demographic, socio-economic and criminal history factors and examined whether a risk assessment tool could be developed based on these factors to assess the risk of future child welfare involvement with sufficient predictive value. Such a risk assessment tool, based on data that can be measured relatively easily in families in the community, is widely applicable to children about whom there are not yet serious concerns, and makes it possible to deploy early preventive interventions.

## Method

### Sample

The sample consisted of all children living in Amsterdam in the year 2015. The total sample consisted of  $N = 131.532$  children (51.1% boys and 48.9% girls). The age of the children varied from 0 to 18, with an average value of 7.83 years ( $SD = 5.23$ ). 94.4% of the children were born in the Netherlands and 5.6% abroad. 52.5% of the mothers were born in the Netherlands and 50.3% of the fathers.

### Data collection

Data were used from the Dutch Central Bureau of Statistics (CBS). At the CBS, demographic, socio-economic and judicial data are available from all people living in the Netherlands. Based on previously performed meta-analyses on risk factors for problematic child-rearing situations (Assink et al., 2018; Brown et al., 1998; Mulder et al., 2019; Sith et al., 2009), the following factors were included: (1) *demographic* factors (child lives with non-biological parent(s), in a single-parent family, in an institutional family, or in a large family, child has divorces parents); (2) *socio-economic* factors (family lives in a rented house, low educational level of father and/or mother, low socio-economic status of father and/or mother, unemployment of father and/or mother,

parent(s) has/have debts, the child attends a lower educational level, special education, is a school drop-out or had dropped to a lower education level); and (3) *criminal history* factors (previous delinquent behavior of the parents and/or the child, the child is registered as a victim at victim support Netherlands).

All (personal) data were retrieved and analyzed completely anonymous and were not traceable to individuals, thereby complying with the Dutch General Data Protection Regulation.

### **Outcome measure**

The outcome measure consisted of child welfare involvement started in the year following the assessment of the risk factors (1 = yes; 0 = no), including supervision orders and out-of-home placements (including guardian placements, foster care placements, residential placements, family-oriented placement).

### **Analyses**

Area Under the receiver-operating-characteristic Curve (AUC) values were calculated to examine the predictive value of the demographic, socio-economic and criminal history factors in predicting child welfare involvement in the year following the assessment of risk factors. In case of positive association, AUC-values vary between .50 (no association) and 1.00 (perfect positive association). AUC-values between .556 and .639 correspond with a small effect size ( $d = .20$ ), between .639 and .714 with a medium effect size ( $d = .50$ ) and from .714 with a large effect size ( $d = .80$ ; Rice and Harris, 2005).

The risk classification was developed by means of chi-squared automatic interaction detector (CHAID) analysis. CHAID is a decision tree classification method that groups cases into subsets of cases with different levels of risk on the basis of particular combinations of variables. This method focuses on interactions between variables rather than on main effects of variables in the dataset being examined. To build the CHAID models, we randomly divided the total group of juveniles into two

groups; about 50% of the sample was used to construct the models (training sample,  $n = 65,276$ ) and about 50% of the sample was used to validate the models (testing sample,  $n = 65,650$ ).

In the first step of the CHAID procedure, the total group of subjects is divided into a number of subgroups on the basis of the variable most strongly associated with the outcome measure. In the second step, the groups are split again on the basis of the variables that are then most strongly associated with the outcome measure. This procedure is repeated until no variables remained that had a significant association with the outcome measure in the subgroups, or until the groups had reached a minimum size. CHAID is appropriate for gaining insight into risk profiles with a high or a low risk, because it identifies groups of cases that share the same risk factors and thus the same risk of truancy recidivism. Another advantage of CHAID is that the results are presented graphically and are therefore easy to interpret.

AUC-values were calculated to examine the predictive value of the risk classification. The AUC-value is regarded as an appropriate measure of predictive validity (Rice & Harris, 2005). In addition, the sensitivity and specificity of the various cut-off scores were examined.

### **Ethical review**

Formal ethical review of this study was not required because: (a) all data were obtained anonymously, and analyzed and reported in the secured digital working environment of the CBS, and (b) all results were solely related to groups and could not be traced to individuals. The results of the analyses were checked by the CBS. With this procedure, the study complied with the rules of the UVA-FMG ethics committee.

## **Results**

### **Predictive value of factors in predicting future child welfare involvement**

Table 1 shows the AUC-values for the demographic, social-economic and criminal history factors for predicting child welfare involvement. In the year after assessment of the risk factors, child welfare involvement was started in .5% of the sample ( $n = 607$ ). This involved  $n = 209$  supervision

orders,  $n = 16$  guardian placements,  $n = 175$  foster care placements,  $n = 62$  residential placements,  $n = 17$  family-oriented placements, and  $n = 178$  out-of-home placements with another stay.

Most factors were significantly associated with future child welfare involvement (i.e. had an AUC value significantly higher than .50), meaning that these factors could be classified as actual risk factors. The following risk factors had a medium effect size (AUC  $> .639$ ): child lives with non-biological parents or in a single-parent family, father has no work, mother has no work, previous delinquent behavior of father and previous delinquent behavior of mother. In addition, the following risk factors had a small effect size (.556  $<$  AUC  $<$  .639): child lives in an institutional family, child is attending a lower school-level, child receives special education, father receives unemployment benefit or other benefit, family lives in a rented home, mother was younger than 25 at the birth of the child, and previous delinquent behavior of the child.

Table 1 also show the AUC value of the variable “total number of risk factors”. This variable indicates the number of risk factors present for each child and has an average value of 2.54 ( $SD = 2.51$ ). The AUC value of this sum variable (AUC = .842) is well above the limit value of a large effect (AUC  $> .714$ ). Figure 1 shows the relationship between the number of risk factors present and the risk of a child protection measure in the 12 months following the assessment of the risk factors. The figure shows that the risk increases exponentially with an increase in the number of risk factors.

### **Development of a risk assessment tool**

To develop a risk assessment tool, a CHAID analysis was performed in which the variables that were significantly associated with future child welfare involvement (see Table 1), and the sum variable “total number of risk factors” were included as independent variables. Based on chi-squared tests, the trainings sample was divided into 11 different risk groups. Figure 2 shows the CHAID output (decision tree), with the gray shaded terminal nodes representing the 11 risk groups in which cases have similar scores on the variables and thus a similar risk of future child welfare involvement. The risk classification was based on a combination of the following eight variables: (1) total numbers

of risk factors, (2) age of the child, (3) previous delinquent behavior of father, (4) previous delinquent behavior of one of the parents, (5) previous delinquent behavior of the child, (6) the child lives in an institutional family. These variables proved to be the strongest predictors for future child welfare involvement and also made an unique contribution to the prediction. The risk of future child welfare involvement 12 months after assessment of the risk factors varies from 0% in the lowest risk group to 10% in the highest risk group (the average risk in the population was .5%)

The predictive validity of the risk classification was good ( $AUC_{\text{training sample}} = .849$ ;  $AUC_{\text{testing sample}} = .843$ ). Figure 3 shows the ROC-curves separately for the training en testing samples and Table 2 shows the sensitivity and specificity at various cut-off points.

### **Discussion**

This study examined whether child welfare involvement could be predicted based on demographic, socio-economic and criminal history factors, with the aim of identifying high-risk families early, so that - if necessary- preventive interventions can be deployed to avoid escalation of problems. An accumulation of risk factors was found to be highly predictive for child welfare involvement 12 months after assessment of the risk factors ( $AUC = .842$ ). The risk of child welfare involvement increased exponentially with an increase in the number of risk factors. In the risk classification constructed by means of a CHAID-analysis, the risk of child welfare involvement 12 months after assessment varied from 0% in the lowest risk group to 10% in the highest risk group (average risk for child welfare involvement 12 months after assessment was .5%). The  $AUC$  value of this risk classification ( $AUC = .843$ ) was comparable with the  $AUC$  value of the accumulation of risk factors ( $AUC = .842$ ). The risk classification shows that in addition of an accumulation of risk factors, some specific risk factors led to an increased risk, such as previously delinquent behavior of the parents or the child or child living in an institutional family.

The results showed that the effect of individual risk factors on future child welfare involvement was generally small, with the exception of the following factors for which a medium

effect was found: child lives with non-biological parents or in a single-parent family, father has no work, mother has no work, previous delinquent behavior of father and previous delinquent behavior of mother. Small effect sizes were found for the following risk factors: child lives in an institutional family, child attends a lower school-level, child attends special education, father receives unemployment benefit or other benefit, family lives in a rented home, mother was younger than 25 at the birth of the child, and previous delinquent behavior of the child. The effect sizes found in the present study are in line with results from previous meta-analyses (Assink et al., 2016; Mulder et al., 2019; Stith et al., 2009).

An accumulation of risk factors appeared to lead to an exponential increase in the risk of child welfare involvement. Such an effect of an accumulation of risk factors has previously been found by Brown and colleagues (1998). They found that an accumulation of risk factors led to an exponential increase in the future prevalence of child abuse and neglect, with the prevalence being 8 times higher when four or more risk factors were present than when no risk factors were present. In the current study, the increase in risk is even stronger than the increase found in the study of Brown and colleagues: when four or more risk factors were present, the risk was 10 times higher and when six or more risk factors were present, the risk was even 21 times higher than when no risk factors were present. These results show that the presence of multiple risk factors lead to a synergistic effect leading to a higher risk of future child welfare involvement than merely the additive effect of individual risk factors.

The risk classification resulting from the CHAID analysis also appeared to be highly predictive of future child welfare involvement. This is especially evident from a comparison with the performance of other risk assessment instruments, such as instrument for child maltreatment (average AUC = .681; Van der Put, Assink, & Boekhout van Solinge, 2017) and instruments for juvenile delinquency (average AUC = .64; Schwalbe, 2007). The risk factors examined in this study consisted of demographic, socio-economic and criminal history factors that relate to the child, the

parents and the family. These factors can be measured without clinical expertise and are relatively easy to measure in families in the community, which is very important for the early detection of families at risk for preventive purposes. The prevalence of child welfare involvement in the year after assessment of the risk factors was very low, namely .5% in the total sample. As a result, the prevalence in the highest risk groups is still relatively low (10% in the highest risk group and 3.2% in the second highest risk group). However, compared to the average prevalence, there is a considerably higher risk in these groups (20 to 6 times higher). It is important that professionals who may use the tool in practice realize that the risk of no child welfare involvement (12 months after assessing the risk factors) is 90% in the highest risk group. That is why it is more appropriate to speak of an *increased* risk of child welfare involvement instead of a high risk. If a longer follow-up period was used then 12 months, the prevalence of child welfare involvement would of course have been higher. Moreover, child welfare involvement often precedes a long period of problems. It would therefore be interesting to examine the prevalence of, for example, reports of child maltreatment, or less severe child and youth care interventions, and how the prevalence relate to the average prevalence. The practical usefulness of the risk classification is that it facilitates early identification of children and families with an increased risk of future child welfare involvement. For appropriate implementation of preventive interventions it is also important to assess dynamic (changeable) risk factors (i.e. needs assessment), to determine treatment goals of intervention. The risk classification developed in the present study consists of static (unchangeable) risk factors and, of course, not all factors that are important for assessing the risk of future child welfare involvement are included, but only risk factors that were available at CBS. Therefore, the risk classification does not consist of an exhaustive list of risk factors that are associated with future child welfare involvement. Another limitation was that some variables had a considerable number of missing values.

Despite these limitations, the results of this study are important for both theory and practice.

The results confirm the finding that the presence of multiple risk factors lead to a synergistic effect, with a (much) higher risk of future child welfare involvement than merely the additive effect of individual risk factors. This finding suggest that the causes of problematic child-rearing situations are likely to be extraordinarily complex and that researchers will need to assess a substantial number of risk and protective factors in order to obtain en more comprehensive understanding of the causes of problematic child rearing situations. Further, the finding indicates that, in order to identify children who are at greatest risk for child welfare involvement, a significant number of risk factors will need to be assessed. In a follow-up study, it is relevant to examine the cumulative effect of additional risk factors that are known to be relatively strong predictors of future child welfare involvement, such as mental health problems of parents, problematic alcohol/drug abuse by parents, and previous incidents of domestic violence or child maltreatment (Assink et al., 2016; Mulder et al., 2019; Stith et al., 2009). Further, it is important to determine whether the risk classification is practically useful in (clinical) practice and whether application (such as digital applications) can be developed based on the risk classification to strengthen clinical practice. Data-driven instruments can help to identify risks in a timely manner and to provide a good prognosis for an intervention or treatment (Riley, 2018). Such instruments are of course no substitute for the conversation between a professional, parents and children. The risk classification is expected to contribute to the timely identification of problematic child-rearing situations, so that preventive interventions can be deployed in a more targeted way to prevent more serious problems. This is in line with an important political aim in the Netherlands, namely, preventive intervention and early use tailor-made help for those children and families who need is.

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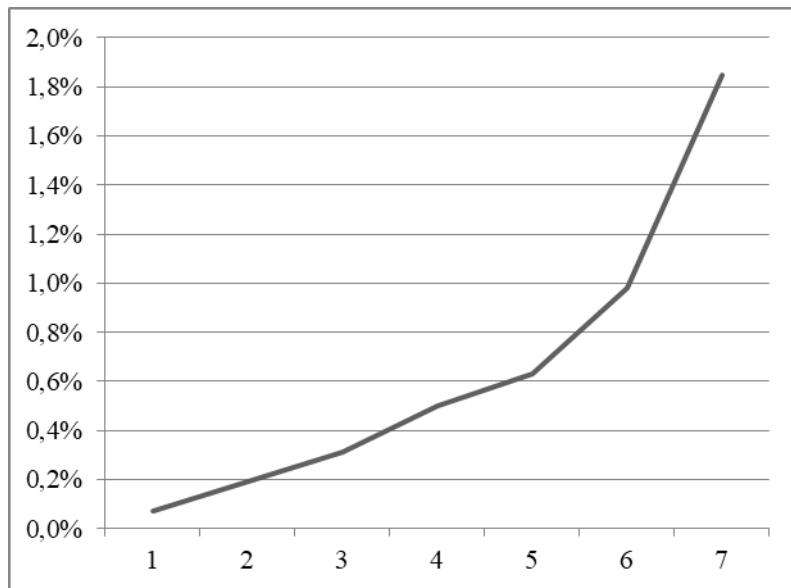
**Figures and tables**

Figure 1

*The level of risk of child welfare involvement (out-of-home placements and supervision orders) in the year following the assessment (y-axis) plotted against the number of risk factors present (x-axis)*

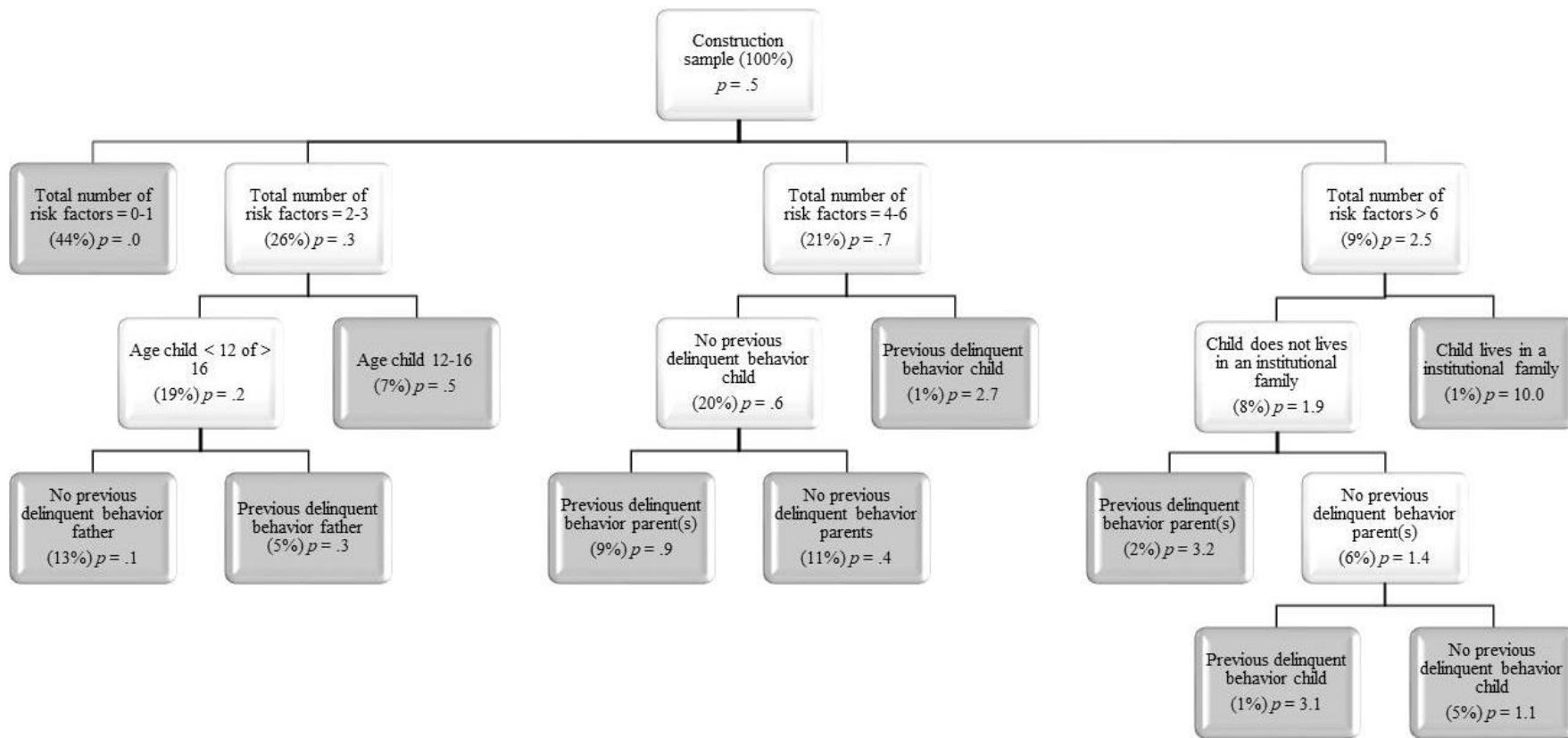


Figure 2

*CHAID-output (decision tree)*

*Note.* \*p = the risk of child welfare involvement in the year following the assessment of risk factors (in percentages). The gray shaded terminal nodes represents the 11 risk groups in which cases have similar scores on the variables and thus a similar risk of future child welfare involvement.

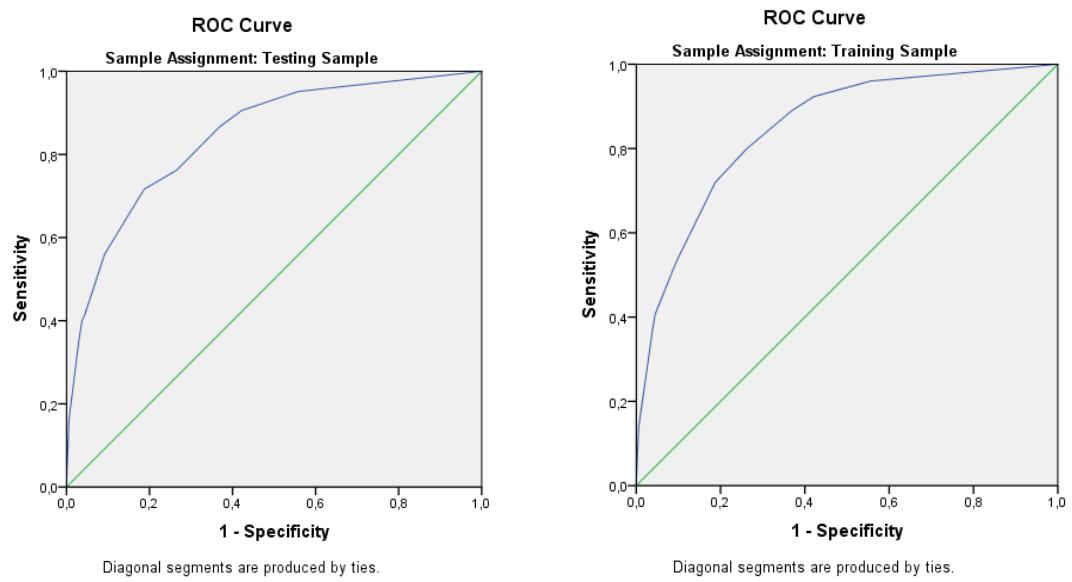


Figure 3

*ROC-curve of the risk classification separately for the testing sample en training sample.*

Table 1

*Prevalence of the risk factors and AUC values for predicting child welfare involvement 12 months after assessment.*

<b>Risk factor (score 1 is the risk category)</b>	<i>%*</i>	<i>AUC</i>
<i>Demographic factors</i>		
Type of household (1 = child lives in a one-parent family or with non-biological parent(s), 0 = child lives on his own or with biological parent(s))	20.7%	.672 (.649 - .696) <sup>b</sup>
Institutional family (1 = child lives in an institutional family, 0 = other)	1.4%	.578 (.552 - .603) <sup>a</sup>
Number of children in the family (1 = 4 or more children, 0 = 3 or less children)	10.9%	.517 (.494 - .541)
Age of mother at the birth of the child (1 = younger than 25 years, 0 = 25 years or older)	14.0%	.590 (.566 - .615) <sup>a</sup>
Age of father at the birth of the child (1 = younger than 25 years, 0 = 25 years or older)	0%	.500 (.477 - .523)
Divorced parents (1 = yes, 0 = no)	2.4%	.509 (.486 - .533)
<i>Socio-economic factors</i>		
Socio-economic status of father (1 = incapacitated for work, social assistance benefit or others social benefits, 0 = other)	11.5%	.615 (.590 - .640) <sup>a</sup>
Socio-economic status of mother (1 = incapacitated for work, social assistance benefit or others social benefits, 0 = other)	7.0%	.519 (.495 - .542)
Educational level of father (1 = lowest educational level, 0 = other)	3.3%	.518 (.495 - .542)
Educational level of mother (1 = lowest educational level, 0 = other)	3.7%	.521 (.498 - .545)
Work father (1 = father is unemployed, 0 = father is employed)	22.2%	.675 (.652 - .699) <sup>b</sup>
Work mother (1 = mother is unemployed, 0 = mother is employed)	49.7%	.679 (.661 - .697) <sup>b</sup>
Type of property (1 = rental property, 0 = purchase property)	22.3%	.612 (.588 - .636) <sup>a</sup>
Parents have debts (1 = yes, 0 = no)	3.5%	.553 (.528 - .577)
Educational level of the child (1 = lowest level of education, 0 = other)	14.5%	.626 (.602 - .651) <sup>a</sup>

<b>Risk factor (score 1 is the risk category)</b>	<b>%*</b>	<b>AUC</b>
Scaling down in education level (1 = yes, 0 = no)	6.0%	.528 (.504 - .552)
Child attends special education ( 1 = yes, 0 = no)	2.1%	.566 (.540 - .591) <sup>a</sup>
Child is an early school dropout (1 = yes, 0 = no)	.1%	.501 (.478 - .524)
<i>Criminal history</i>		
Previous delinquent behavior of father (1 = yes, 0 = no)	23.8%	.689 (.666 - .712) <sup>b</sup>
Previous delinquent behavior of mother (1 = yes, 0 = no)	7.4%	.647 (.622 - .673) <sup>b</sup>
Previous delinquent behavior of the child (1 = yes, 0 = no)	2.1%	.568 (.543 - .593) <sup>a</sup>
Previous truancy offenses (1 = yes, 0 = no)	.2%	.503 (.480 - .526)
<i>Total number of risk factors</i>		.842 (.827 - .857) <sup>c</sup>

*Note.* \* % of the sample where the risk factor is present (score 1); a = small effect (.556 < AUC value <

.639); b = medium effect (.639 < AUC value < .714); c = large effect (AUC value > .714).

Tabel 2

*Sensitivity and specificity at various cut-off points of the risk classification (testing sample n = 65,650).*

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Cut-off point (>) <sup>a</sup>	Sensitivity	Specificiy
.000	1.00	.000
.001	.951	.443
.002	.906	.578
.003	.866	.631
.004	.762	.735
.007	.717	.813
.010	.560	.908
.019	.414	.956
.029	.401	.963
.031	.349	.971
.066	.160	.994
1.00	.000	1.00

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*Note.* <sup>a</sup>If a test score is greater than the cut-off point (risk of child welfare involvement in the year after assessment of the risk factors), the test result is considered positive; a test score smaller than the cut-off point is considered negative .