

Article

Risk Factor for Child Maltreatment at 3 Years of Age in Japanese Multiples and Singletons: A Population-Based Study

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Abstract

We evaluated the prevalence and risk factors for child maltreatment in multiples aged 3 years and compared them to singletons in Japanese population-based data. Records on child maltreatment and health check-ups at 3 years of age from 17,125 singletons, 488 twins and 18 triplets were collected from a Public Health Center between April 2007 and March 2011. The associations of child maltreatment with potential risk factors were analyzed using the logistic regression model. Out of all children, 76 (4.31 per 1000) children had documented maltreatment including 69 (4.03 per 1000) singletons and seven (14.31 per 1000) twins. All of the cases in twins were physical abuse (100%) and nearly half of the cases (43%) included emotional abuse. Among twins, 86% of the biological mothers were suspected. The alleged perpetrators of twins showed a significantly higher rate of maternal depression compared to those of singletons. After adjusting the results for a number of potential biological and social risk factors, twins or triplets had a higher risk for maltreatment than singletons (OR 3.39, 95% CI [1.17, 9.83]). Healthcare providers should be aware that a multiple birth can place considerable stress on a family leading to child maltreatment and should provide appropriate support and intervention for mothers with multiples.

Keywords: Child maltreatment; Maternal depression; Maternal self-rated health; Twins; Advisers for childrearing

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Child maltreatment is globally recognized as a serious health and social problem as it not only directly threatens a child's health and safety but can also result in lifelong impediments, such as delayed growth and development, as well as socioeconomic disparities (Chartier et al., 2007; Chen et al., 2016; Gilbert et al., 2009; Norman et al., 2012; Ooki, 2013a). The Convention on the Rights of the Child emphasizes that all children have the right to receive appropriate care, ensuring healthy growth, development and independence (UNICEF, 1990), and thus the prevention of child maltreatment is a crucial societal obligation. In Japan, the number of child maltreatment consultations is constantly increasing despite a decreasing number of children due to the declining birthrate (Ministry of Health, Labour and Welfare [MHLW], 2020). Against this background, local governments should provide effective maternal and child healthcare services and systems to prevent child maltreatment (World Health Organization [WHO], 2019).

There have been few population-based studies on maltreatment in cases of multiple births despite the general recognition that multiple births increase the risk of child maltreatment (Tanimura et al., 1990). Using the US national vital statistics data, Luke and Brown (2007) reported that even among healthy and full-term infants, twins had a higher mortality risk due to maltreatment compared to singletons. Furthermore, Japanese nationwide data

and case reports of child deaths indicated that the nonspecific burden of child rearing might be a risk factor for child maltreatment in families with multiple births. However, fatal maltreatment cases of newborn twins were rare (Ooki, 2013a). Since these reports were based on records of child deaths due to maltreatment and thus include only the most serious cases, there is still limited knowledge on the prevalence and risk factors for child maltreatment in multiple births.

Nearly half of the maltreated children in Japan are preschool-aged (Statistics of Japan, 2024). The Mother and Child Health Law stipulates that the last year of the national health check-up is at the age of 3 years. It is important to identify the factors associated with the risk of child maltreatment among healthy multiples using health check-up information for children up to that age. However, to our knowledge, there are few population-based studies that have explored the risk for child maltreatment among multiples aged 3 years using municipality records on child maltreatment linked to health check-up data. Therefore, we evaluated the prevalence and risk factors for child maltreatment in multiples aged 3 years and compared them to singletons in Japanese population-based data.

Data and Methods

In Japan, pediatricians and dentists at regional Public Health Centers generally perform routine health check-ups as a mass examination, while public health nurses are responsible for parent consultations on child rearing at that time. In a Japanese city

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referred to as City A, over 90% of children aged 3 years received these health check-ups between April 2007 and March 2011. The city has a population of 453,000 people and approximately 4600 births annually. Suspected child maltreatment cases reported by public health nurses during maternal and child health activities, such as health check-ups, health consultations, home visits and health education sessions, were evaluated based on the severity of the maltreatment (high risk, doubt, mild to moderate, and severe) in Regional Councils for Children Requiring Care. When a child was judged to be a victim of child maltreatment (doubt, mild to moderate, and severe), the child was registered with the Regional Councils for Children Requiring Care in City A.

Data from these health check-ups and records on child maltreatment are filed at municipal health centers. The records gathered by a Public Health Center in City A were used in this study. The data were then anonymously transferred to the research group. Records of support from public health nurses for families with a child aged 3 years and registered with the Regional Councils were linked to the health check-up data. Definitions of child maltreatment and parental guardian were based on the Child Abuse Prevention Law of Japan promulgated in 2000. The types of maltreatment reported include physical abuse, psychological abuse, neglect and sexual abuse. In total, 17,124 (97.13%) of the participants were singletons, 489 (2.77%) were twins, and 18 (0.10%) were triplets.

We focused the analyses on child maltreatment for children aged 3 years that occurred between April 2007 and March 2011. The database records we examined contained birth records (sex, multiple birth status, and birth weight), infancy health check-up data (holding head up, sitting alone, walking alone, abnormality of the infant's nervous system, dental caries, and weight at 3 years of age), obstetric history (abnormalities during pregnancy and mode of delivery), and the characteristics of the mother (maternal self-rated health, advisers for child rearing, cooperation from other family members or relatives in child rearing, and maternal employment status). The classification of motor functions in infants was based on the period when more than 90% of infants are able to hold their own head up, sit alone, and walk alone in a national growth survey on preschool children (MHLW, 2010). The criteria were as follows: holding head up, ≤ 4 months and ≥ 5 months; sitting alone, ≤ 9 months and ≥ 10 months; and walking alone, ≤ 15 months and ≥ 16 months. Maternal self-rated health was evaluated according to a 3-grade self-rating scale of 1 (*good*), 2 (*normal*) and 3 (*poor*). Additionally, the records on child maltreatment at 3 years of age included information on the type of child maltreatment, perpetrator, the sex of the child, the number of children in the family, maternal depression, father's mental illness, domestic violence, fatherless family, mother who was abused during her childhood, low ability of child rearing, household receiving welfare benefits, and situation of twin pair.

Statistical Analysis

The statistical analysis was conducted using SPSS version 29.0 for Windows (Japanese IBM Corporation, Tokyo, Japan). The independence of nominal-level variables was assessed using the χ^2 -test. To identify factors associated with child maltreatment, forced-entry multiple logistic regression analysis was performed with child maltreatment as the dependent variable. In addition to a model including each factor separately (model 1), an adjusted model (model 2) was calculated including infant characteristics,

obstetric history, and the characteristics of the mother described above. When using the logistic regression model, the item on abnormality of the infant's nervous system was excluded due to the small number of cases for the analysis.

Results

Table 1 shows the characteristics of participating children by multiple status based on health check-ups at 3 years of age. Twins and triplets had lower birth weight and showed higher rates of delayed holding head up, sitting alone, and walking alone compared to singletons. They also had a lower rate of dental caries and lower weight at 3 years of age. When considering maternal characteristics (Table 2), mothers who had twins and triplets had a higher rate of abnormalities during pregnancy and reported poorer self-rated health compared to those who had singletons. Families with triplets reported more often lacked advisers for childrearing and noncooperation from other family members or relatives in childrearing compared to families with singletons.

Overall, 76 (4.31 per 1000) children had documented maltreatment: 69 (4.03 per 1000) singletons and seven (14.31 per 1000) twins (Table 3). Nearly half of the cases in singletons were physical abuse (42%), whereas emotional abuse and neglect attributed to approximately a quarter each (20% and 30% respectively) of the cases. All of the cases in twins were physical abuse (100%) and 43% of cases also included emotional abuse. There were no cases of sexual abuse in singletons or twins. In the child maltreatment cases of singletons, 74% of the alleged perpetrators were biological mothers; biological fathers, stepfathers or parents' boyfriends, and both biological father and mother accounted for 8%, 3% and 15% cases of child maltreatment respectively. In twins, 86% of the alleged perpetrators were biological mothers. The alleged perpetrators of twins showed a significantly higher rate of maternal depression compared to those of singletons ($p = .003$). The proportion of male and female victims of opposite-sex pairs accounted for 29% and 14% respectively. The proportion of male and female victims of same-sex pairs was 57% and 0% respectively. The pairwise concordance rate of child maltreatment among twins was 0.75 (= 3/4). In addition, the mothers with twins who were the alleged perpetrators more often reported poor self-rated health (43%) compared to other mothers with twins (3%; $p < .001$).

Finally, we conducted a logistic regression analysis for child maltreatment with associated factors as independent variables (Table 4). Multiple birth (twins or triplets) was independently associated with a greater risk for child maltreatment: the odds ratio (OR) indicated that twins or triplets were 3.39 (95% CI [1.17, 9.83]) times more likely to be maltreated than singletons. Poor self-rated health of mothers was independently associated with a greater risk for child maltreatment; the OR indicated that mothers reporting poor self-rated health were 14.53 (95% CI [8.02, 26.33]) times more likely to be alleged perpetrators than mothers who were not. Lack of an adviser for child rearing was associated with child maltreatment, where mothers who had no adviser for child rearing were 3.31 (95% CI [1.19, 9.21]) times more likely to be alleged perpetrators than those who had advisers. Noncooperation from other family members or relatives for child rearing, and maternal employment status were associated with child maltreatment. We also checked the interaction effects of multiple status with the other risk factors of child maltreatment, but none of them were statistically significant (p values .099–.398).

Table 1. Major characteristics of singletons, twins and triplets aged 3 years

		Singletons <i>n</i> = 17,124		Twins <i>n</i> = 489		Triplets <i>n</i> = 18		<i>p</i> value
Sex	Boy	8906	(52.0%)	258	(52.8%)	11	(61.1%)	<i>p</i> = .704
	Girl	8218	(48.0%)	231	(47.3%)	7	(38.9%)	
Birth weight (g)	<1500	78	(0.5%)	22	(4.5%)	5	(27.8%)	<i>p</i> < .001
	1500 ≤ <i>a</i> <2000	124	(0.7%)	85	(17.4%)	11	(61.1%)	
	2000 ≤ <i>a</i> <2500	1028	(6.0%)	235	(48.1%)	2	(11.1%)	
	2500 ≤	15,883	(92.8%)	147	(30.1%)	0	(0.0%)	
Holding head up	≤4 months	16,131	(95.4%)	412	(86.2%)	9	(50.0%)	<i>p</i> < .001
	≥5 months	772	(4.6%)	66	(13.8%)	9	(50.0%)	
Sitting alone	≤9 months	16,342	(98.1%)	441	(93.4%)	18	(100.0%)	<i>p</i> < .001
	≥10 months	316	(1.9%)	31	(6.6%)	0	(0.0%)	
Walking alone	≤15 months	15472	(91.2%)	416	(86.1%)	14	(77.8%)	<i>p</i> < .001
	≥16 months	1484	(8.8%)	67	(13.9%)	4	(22.2%)	
Abnormality of infant's nervous system at 3 years	Not suspected	17092	(99.8%)	486	(99.4%)	18	(100.0%)	<i>p</i> = .110
	Suspected	32	(0.2%)	3	(0.6%)	0	(0.0%)	
Dental caries	0	14289	(83.6%)	440	(90.3%)	16	(88.9%)	<i>p</i> = .001
	1–4	2241	(13.1%)	42	(8.6%)	2	(11.1%)	
	≤5	555	(3.2%)	5	(1.0%)	0	(0.0%)	
Birth weight (g)	Boys' mean ± <i>SD</i>	3078.3 ± 409.5		2314.0 ± 403.3		1627.8 ± 334.0		<i>p</i> < .001
	Girls' mean ± <i>SD</i>	2996.9 ± 398.0		2245.8 ± 398.6		1626.6 ± 161.3		
Weight at 3 years of age (kg)	Boys' mean ± <i>SD</i>	14.9 ± 1.73		14.0 ± 1.34		14.4 ± 0.75		<i>p</i> < .001
	Girls Mean ± <i>SD</i>	14.1 ± 1.49		13.8 ± 1.51		13.0 ± 0.88		

Table 2. The characteristics of the mother by singletons, twins and triplets aged 3 years

		Singletons <i>n</i> (%)		Twins <i>n</i> (%)		Triplets <i>n</i> (%)		<i>p</i> value
Abnormalities during pregnancy	No	13667	(79.8%)	235	(48.1%)	6	(33.3%)	<i>p</i> < .001
	Yes	3457	(20.2%)	254	(51.9%)	12	(66.7%)	
Mode of delivery	Vaginal delivery	14547	(85.0%)	129	(26.4%)	0	(0.0%)	<i>p</i> < .001
	Cesarean section	2577	(15.0%)	360	(73.6%)	18	(100.0%)	
Maternal self-rated health	Good	8730	(52.2%)	210	(43.9%)	6	(33.3%)	<i>p</i> = .002
	Normal	7596	(45.4%)	254	(53.0%)	12	(66.7%)	
	Poor	396	(2.4%)	15	(3.1%)	0	(0.0%)	
Advisers for childrearing	No	255	(1.5%)	10	(2.0%)	3	(16.7%)	<i>p</i> < .001
	Yes	16869	(98.5%)	479	(98.0%)	15	(83.3%)	
Cooperative from other family members of relatives for childrearing	Non-cooperative	719	(4.2%)	19	(3.9%)	3	(16.7%)	<i>p</i> = .029
	Cooperative	16405	(95.8%)	470	(96.1%)	15	(83.3%)	
Maternal employment status	No job	12185	(73.1%)	331	(69.7%)	15	(100.0%)	<i>p</i> = .038
	Full-time job	2502	(15.0%)	88	(18.5%)	0	(0.0%)	
	Part-time job	1984	(11.9%)	56	(11.8%)	0	(0.0%)	

Discussion

In this study, we analyzed the risk of child maltreatment among multiples aged 3 years in Japan. During our study period from April 2007 to March 2011, there were 4.31 maltreatment cases in

this age group per 1000 children: 4.03 per 1000 children for singletons and 14.31 per 1000 children for twins. The incidence rate of maltreatment per 1000 children was 2.76 for those under the age of 18 years and 4.31 for children aged 3 to 5 years in a study by the MHLW (2012) of Japan using information from 206 child

Table 3. Type of child maltreatment and characteristics of perpetrator and victim aged 3 years

		Singletons <i>n</i> = 69 (%)		Twins <i>n</i> = 7 (%)		<i>p</i> value
Type of child maltreatment ^a	Emotional abuse	14	(20.3%)	3	(42.9%)	<i>p</i> = .172
	Physical abuse	29	(42.0%)	7	(100.0%)	<i>p</i> = .003
	Neglect	21	(30.4%)	0	(0.0%)	<i>p</i> = .086
Perpetrator	Biological mother	49	(74.2%)	6	(85.7%)	<i>p</i> = .630
	Biological father	5	(7.6%)	1	(14.3%)	
	Stepfather or parent's boyfriend	2	(3.0%)	0	(0.0%)	
	Biological father and mother	10	(14.9%)	0	(0.0%)	
Gender of victim	Male	40	(58.0%)	6	(85.7%)	<i>p</i> = .153
	Female	29	(42.0%)	1	(14.3%)	
Number of children in one family	≤2	50	(73.5%)	3	(42.9%)	<i>p</i> = .188
	3	14	(20.6%)	4	(57.1%)	
	4	1	(1.5%)	0	(0.0%)	
	≤5	3	(4.4%)	0	(0.0%)	
Maternal depression	No	60	(87.0%)	3	(42.9%)	<i>p</i> = .003
	Yes	9	(13.0%)	4	(57.1%)	
Father's mental illness	No	67	(97.1%)	7	(100.0%)	<i>p</i> = .648
	Yes	2	(2.9%)	0	(0.0%)	
Domestic violence	No	61	(88.4%)	6	(85.7%)	<i>p</i> = .834
	Yes	8	(11.6%)	1	(14.3%)	
Fatherless family	No	60	(87.0%)	5	(71.4%)	<i>p</i> = .266
	Yes	9	(13.0%)	2	(28.6%)	
Mother who was abused during her childhood	No	67	(97.1%)	7	(100.0%)	<i>p</i> = .648
	Yes	2	(2.9%)	0	(0.0%)	
Low ability of child rearing	No	62	(89.9%)	7	(100.0%)	<i>p</i> = .376
	Yes	7	(10.1%)	0	(0.0%)	
Household receiving welfare benefits	Yes	60	(87.0%)	5	(71.4%)	<i>p</i> = .341
	No	9	(13.0%)	2	(28.6%)	
Birth weight of victim	<1500g	1	(1.4%)	0	(0.0%)	<i>p</i> < .001
	1500g ≤a <2000g	1	(1.4%)	2	(28.6%)	
	2000g ≤a <2500g	4	(5.8%)	4	(57.1%)	
	2500g ≤	63	(98.4%)	1	(1.6%)	
Weight at 3 years of age of victim	Mean ± SD (kg)	14.40 ± 1.60		12.92 ± 1.40		<i>p</i> = .025
Twin pair						
Sex-combination of twin pair (per twin individual)	Boy of opposite-sex			2	(28.6%)	
	Girl of opposite-sex			1	(14.3%)	
	Boy of same-sex			4	(57.1%)	
	Girl of same-sex			0	(0.0%)	
Pairwise concordance	Both twins maltreated (pairs)			3	(75.0%)	
	One twin maltreated (pairs)			1	(25.0%)	

Note: ^aincludes plural type of maltreatment in a case.

consultation centers throughout Japan. Therefore, the incidence rate of child maltreatment reported in our study was nearly the same as that of children aged 3 to 5 years reported by the Japanese Ministry.

Consistent with previous studies (Luke & Brown, 2007; Ooki, 2013b), after adjusting for each associated factor, we found that families with multiple births aged 3 years showed an increased risk for child maltreatment. Specifically, all of the cases in twins were

Table 4. Logistic regression model on child maltreatment and associated factors

		Model 1 (unadjusted)			Model 2 ^a		
		OR	95% CI	<i>p</i> value	Adjusted OR	95% CI	<i>p</i> value
Multiple births	Singleton	1.00			1.00		
	Twin or Triplet	2.92	1.26, 6.76	<i>p</i> = .012	3.39	1.17, 9.83	<i>p</i> = .025
Maternal self-rated health	Good or Normal	1.00			1.00		
	Poor	15.05	8.71, 25.99	<i>p</i> < .001	14.53	8.02, 26.33	<i>p</i> < .001
Advisers for childrearing	Yes	1.00			1.00		
	No	7.83	3.72, 16.45	<i>p</i> < .001	3.31	1.19, 9.21	<i>p</i> = .022
Cooperative from other family members of relatives for childrearing	Cooperative	1.00			1.00		
	Non-cooperative	3.90	2.05, 7.42	<i>p</i> < .001	2.44	1.06, 5.60	<i>p</i> = .036
Maternal employment status	Not working	1.00			1.00		
	Full-time employed	2.23	1.28, 3.90	<i>p</i> = .005	2.76	1.52, 5.03	<i>p</i> < .001
	Part-time employed	2.71	1.17, 6.30	<i>p</i> = .020	3.21	1.23, 7.97	<i>p</i> = .012

Note: OR, odds ratio; CI, confidence interval

^aModel 2 adjusted for children's characteristics (sex, multiple birth, birth weight, holding head up, sitting alone, walking alone, and dental caries, weight at 3 years of age), obstetric history (abnormalities during pregnancy, and mode of delivery), and maternal characteristics (maternal self-rated health, advisers on child rearing, cooperation from other family members or relatives in child rearing, and maternal employment status).

physical abuse (100%), whereas nearly half of the cases in singletons were physical abuse (43%). Multiples have many risk factors, including low birth weight and a higher risk for disabilities (Lorenz, 2012; Premru-Srsen et al., 2015). Indeed, motor developmental delays of multiples at 3 years of age in this study were higher compared to those of singletons, and the weight of multiples was lower than singletons. Additionally, previous research has reported that male infants are at a higher risk for death due to maltreatment during infancy (Luke & Brown, 2007; Marks & Kumar, 1993). These previous studies were consistent with our result that 86% of the victims among twins were male infants.

A specific feature related to families with twins is the rearing of two children of the same age at the same time, which has been found to overburden parents — especially the mother — physically, mentally and socially (Denton, 2005). Moreover, it might be a much more stressful situation for a mother to nurture older children along with twins (Salami et al., 2003). Meanwhile, a large number of studies have shown that parental mental health problems predispose to child maltreatment (Ayers et al., 2019; Pawlby et al., 2011; Thompson et al., 2013). Windham et al. (2004) reported that severe physical assault in children was significantly associated with maternal depression. Mothers of twins are more likely to experience depression than mothers of singletons (Thorpe et al., 1991). In our study, approximately 60% of mother with twins who were alleged perpetrators experienced depression, while 13% of mothers with singletons who were alleged perpetrators experienced depression. Additionally, in the present study, mothers who showed poor self-rated health had 13 times higher risk for child maltreatment compared to mothers who reported good or normal health, and mothers of twins who were alleged perpetrators showed a higher rate of poor self-rated health than those who were not. In families with twins, the physical and mental overburden of child rearing in general rather than factors specific to multiples might be the main risk factors for child maltreatment. These results suggest that mothers with twins and triplets need to be supported to reduce the burden of child rearing.

Social support has been found to enable mothers to cope more effectively with the stress of having a baby (Ni & Siew Lin, 2011; Razurel et al., 2013). Meanwhile, several studies have also indicated that a lack of social support is associated with the risk of child maltreatment (Garbarino & Sherman, 1980; Whipple & Webster-Stratton, 1991). Similarly, in the present study, after adjusting for each associated factor using logistic regression modeling, mothers with no childrearing advisers, as well as mothers experiencing noncooperation from other family members or relatives, were more likely to be perpetrators of child maltreatment. Families with twins and triplets had a higher rate of lacking advisers for childrearing and noncooperation from other family members or relatives in childrearing compared to those who had singletons. Health providers should offer appropriate support for these mothers, such as the utilization of home help services, among other measures.

Related to maternal employment status, previous studies have shown that women who are employed part-time exhibit adverse health behaviors compared to those who are employed full-time, partially mediated by stress and depression (Rosenthal et al., 2012). In the present study, maternal employment status was found to be associated with the risk of child maltreatment: mothers who were employed both part-time and full-time were approximately 3 times more likely to be the alleged perpetrator compared to those who were not employed. While maternal employment may improve income, it may also increase stress and decrease time with children. It is indicated that maternal employment is associated with worse child health (Brauner-Otto et al., 2019). In this study, mothers with twins had a higher rate of those who were employed full-time compared to mothers with singletons. Therefore, measures are needed to reduce stress and provide support for employed women in childrearing.

Data on parental age, parental education, breast-feeding, and family income were lacking in this study. These factors may be associated with child maltreatment (Dakil et al., 2011; Kremer & Kremer, 2018) and should be investigated in future studies. Additionally, the rate of health check-ups for children aged 3 years

in this study was not 100%, even though it was high (over 90%). It is indicated that there is a high probability for children who have not undergone a health checkup to be maltreated in Japan (Matsunoga et al., 2005).

In conclusion, this study using population-based data for children aged 3 years showed that the incidence rates of child maltreatment determined at health check-ups were 4.03 per 1000 children for singletons and 14.31 per 1000 children for twins. After adjusting for each associated factor using logistic regression, we found that families with multiples aged 3 years showed an increased risk for child maltreatment. Mothers of twins who were alleged perpetrators showed a higher rate of depression than mothers of singletons who were alleged perpetrators. Mothers of twins also showed a higher rate of poor self-rated health compared to mothers of singletons. Healthcare providers should be aware that multiples can place considerable stress on a family and should provide appropriate support and intervention, starting with recognizing that mothers with these factors are potentially a high-risk group.

Availability of data. Data cannot be shared for privacy or ethical reasons.

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Author contributions. YY and OY conceived the idea of the study. YY developed the statistical analysis plan and conducted statistical analyses. YY drafted the original manuscript and supervised the conduct of this study. KS and OY reviewed the manuscript draft and provided important comments on the draft manuscript. All authors approved the final version of the manuscript.

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Competing interests. None.

Ethics approval and consent to participate. All methods were carried out in accordance with relevant guidelines and regulations of the Declaration of Helsinki of 1975, as revised in 2008. The study protocol was approved by the Ethics Committee of Osaka Metropolitan University (formerly Osaka City University), Japan (Study ID: 24-2-2). To protect confidentiality, the data were transferred anonymously to computerized files by City A staff. Since we used administrative data, written informed consent was not obtained, which was approved by the Ethics Committee.

Consent for publication. There are no details on individual participants within the manuscript.

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