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Association of municipality-implemented maternal and child health services with infant abuse signs: an ecological study in Japan

Sayaka Tabuchi

s-tabuchi@mail.koka.ac.jp

Kyoto Koka University

Kazuya Taira

The University of Osaka

Mikiko Ito

Shiga University of Medical Science

Misa Shiomi

Kyoto University

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Abstract

Background

In Japan, psychological abuse is the most common form of infant abuse, mostly perpetrated by biological mothers. Early intervention during pregnancy and robust maternal and child health (MCH) services are critical public health strategies for prevention. Although Japan's policy provides an MCH service framework through statutory requirements, implementation relies on mandatory and municipality-specific expansion services. Consequently, delivery varies by municipality, and its impact on abuse risks remains underexplored. We examined relationships among MCH services from pregnancy to postpartum under national policy, abuse signs, and each measure's preventive role.

Methods

Aggregated administrative data were collected using a standardized form targeting 1,718 Japanese municipalities (February–June 2024). MCH service performance (process) and infant abuse signs at 3–4 months (outcome) were analyzed using the Donabedian model. From 356 responding municipalities, 238 with data were included. The primary outcome was the absence of abuse signs, while secondary outcomes were physical and psychological abuse signs. Process indicators included home-visiting and screening criteria to identify pregnant/postpartum women requiring support. A negative binomial model with log-link was used; overdispersion was confirmed by likelihood ratio tests ($p < 0.05$). Incidence rate ratios (IRRs) were also calculated.

Results

The mean municipal rate for "Absence of abuse signs" was 90.56% ± 11.2%, while the rates for psychological and physical abuse signs were 4.07% ± 2.7% and 0.67% ± 0.7%, respectively. "Postpartum health checkup programs" were significantly associated with the primary outcome (IRR = 1.024, $p = 0.012$). "Home visits for pregnant women" showed a marginal association without statistical significance (IRR = 1.044, $p = 0.074$). "Psychological abuse signs" were associated with "Introduction of the public health nurse in charge at MCH Handbook Issuance" (IRR = 1.260, $p = 0.022$) and "Edinburgh Postnatal Depression Scale screening criteria" (≥ 9 points) (IRR = 0.706, $p < 0.01$). "Physical abuse signs" were associated with the "Number of public health nurses for MCH" (IRR = 1.070, $p = 0.037$) and "Support decision criteria for pregnant women requiring support excluding specified expectant mothers" (IRR = 1.235, $p = 0.040$).

Conclusions

Municipal MCH service structures—including deployment of public health nurses and identification of pregnant women requiring outreach and support—may assist in infant abuse detection. Enhanced local implementation under national policy frameworks could strengthen the public health infrastructure against infant abuse.

Background

International trends in child abuse and the current state and challenges of support systems surrounding infant abuse

Child abuse is a significant public health issue that impedes children's healthy development. The reported incidence of infant abuse is high: 13.8 per 1,000 children in the United States (2023) [1] and 13.8 per 1,000 children in Australia (2022) [2]. A defining characteristic is that these rates are significantly higher in infants aged < 1 year than in older age groups. Previous research has suggested the efficacy of early intervention, from pregnancy through the immediate postnatal period. For example, international reports have indicated that early intervention support through home visits by nurses during pregnancy helps to reduce the incidence of abuse and neglect [3] and that home visits are the only evidence-based method for mitigating abuse [4]. Furthermore, other studies have shown that when nurses provide continuous and personalized care to pregnant women and new mothers facing challenges, such as mental health risks or domestic violence, their satisfaction with the received care significantly increases [5].

However, comprehensive evidence on the overall effectiveness of abuse prevention interventions specifically targeting pregnant women with psychosocial risks remains insufficient [6, 7]. Furthermore, considering that differences in the age and experience of public health nurses (PHNs) may influence the detection of abuse [8], standardizing intervention support systems and developing specialized capabilities for PHNs remain a persistent challenge.

Maternal and child health policies and high-risk approaches in Japan

Under Japan’s Maternal and Child Health (MCH) system, there is a clear division of roles between medical institutions and local municipalities. Whilst medical institutions (hospitals and clinics) focus on clinical care such as antenatal check-ups, delivery management, and postnatal check-ups, local authorities are legally obliged—under the MCH Act—to provide ongoing services, including health consultations and home visits, to ensure the welfare of all families in the local community while flexibly combining them with municipality-specific expansion (discretionary) services. Through this blended approach involving mandatory frameworks and local adjustments, municipalities are expected to play a tailored, leading role in measures to prevent child abuse. In Japan, the number of reports concerning child abuse reached a record high of 225,509 in the 2023 fiscal year [9]. While this statistic in itself is a public concern, it is reported that infants < 1 year of age account for approximately 70% of abuse-related deaths, excluding parent–child suicides, and that biological mothers are the most common perpetrators of infant abuse [10]. Consequently, preventive measures remain an urgent priority. The 2016 revision of the MCH law clearly defined local government responsibilities, emphasizing the importance of assessing “prenatal risks,” such as unmarried status or history of induced abortion, at the time of pregnancy registration and implementing a high-risk approach based on this assessment [11]. A key feature of Japan's MCH policies is the dual approach: a population-based approach targeting all mothers and children, and a high-risk approach targeting “Specified Expectant Mothers (SEMs),” who require additional childcare support prior to giving birth. SEMs include those who are expected to face difficulties raising a child due to an unstable income or intellectual or mental disabilities, as well as those who require additional postpartum support due to domestic violence or teenage pregnancy [12]. By registering with the Regional Council for Measures against Children in Need of Protection in each municipality, continuous support can be received. This council is a local consultative body that aims to identify abused children in need of protection early and provide appropriate support through cooperation among relevant organizations [13]. There is a system in Japan whereby a MCH handbook is issued upon submission of a pregnancy notification. PHNs have been reported to conduct interviews at this time to assess child abuse risk and anxieties about childcare, and to initiate necessary support [14, 15]. An FY2023 survey found that 99.9% of local governments assessed and evaluated the status of pregnant women at the time of pregnancy registration [16], indicating that a nationwide

screening system is in place. By prefecture, the proportion of designated pregnant women in relation to the total number of births varies from 0.3% to 2.8%, demonstrating considerable variation [17].

Factors related to child abuse and challenges of disparities between municipal approaches and responses

Previous studies have identified a wide range of factors contributing to child abuse. Demographic and economic attributes include parental age, educational background, and economic hardship [18]. Concerning caregiver background, the “negative cycle of abuse” stemming from the parent's own history of abuse has been reported [19, 20]. Poor maternal health and postpartum depression tendencies [20] were noted in terms of health status. Regarding feelings of childcare burden, associations have been reported with multiple births [21] and low birth weight [20]. Building on these findings, mechanisms for the early identification of at-risk caregivers and children have been established. For example, according to Japan's 2023 MCH Services Report, 91.3% of municipalities have established criteria to provide information to regional child protection networks (Regional Councils for Children Requiring Protection) when continuous support is deemed necessary during the issuance of MCH handbooks or prenatal/postnatal home visits. Furthermore, 99.4% of municipalities shared information with medical institutions when identifying families needing parenting support during pregnancy [22]. However, at the practical level, “screening operations for those requiring support” and “criteria for determining when to end support” vary by municipality [17], and it is anticipated that differences exist between local governments’ programs within many municipalities.

Study aim

Although research on individual-level factors contributing to child abuse has accumulated, studies examining how differences in screening criteria and policy implementation systems across municipalities affect the early detection of suspected abuse remain scarce. Therefore, this study aimed to analyze the relationship between the implementation of MCH services at the Japanese municipality level and infant abuse signs among those aged 3–4 months, referencing the Donabedian model [23]. The role of each measure in preventing infant abuse was also evaluated.

Methods

Study design and population

This ecological study evaluated municipality-level maternal and child health (MCH) statistics across Japan. Aggregated administrative data were collected from the 1,718 municipal governments between February 27 and June 26, 2024. This study initially comprised all 1,737 municipalities in Japan as of 2023. However, considering the burden on local governments, 19 municipalities in Ishikawa Prefecture affected by the Noto Peninsula Earthquake on January 1, 2024, were excluded. Data submission was requested from the chief PHNs in the remaining 1,718 municipalities. We received data from 356 municipalities (return rate: 20.7%). After screening for eligibility, 118 cases were excluded due to missing values or outcome variables exceeding 100% (likely due to reporting errors at the municipal level). Ultimately, 238 municipalities were included in the final analysis (Fig. 1). This study was approved by the Ethics Review Committee of Shiga Medical University (approval number: R2023-111; approved January 12, 2024). The analytical framework referenced the Donabedian model [23], consisting of structure,

process, and outcome. We examined the relationship between MCH systems (process) and the occurrence of signs of abuse (outcome), while adjusting for regional characteristics (structure) (Fig. 2). The data collection items on the municipal record sheet were developed by referencing the standard reporting indicators used in Phase 2 of "Healthy Parents and Children 21"—a nationwide initiative aimed at improving the health standards of mothers and children in Japan [24]. Phase 2 was implemented from fiscal year (FY) 2015 to 2024. By using these established national reporting standards as a basis for our indicators, we aimed to ensure the validity of the items and minimize measurement bias. Whereas process variables based on the municipal administrative statistics data were analyzed for FY2022, outcome data were collected for a 4-year period (FY2019–2022) via this record sheet to ensure statistical stability for municipalities with low annual birth counts.

Variables and data sources

Outcome Variables: Signs of Abuse

National indicators for the early detection of abuse for infants aged 3–4 months were used as outcome variables. The primary outcome was rate of the absence of abuse signs, while secondary outcomes were physical and psychological abuse signs. Detailed administrative data items, secondary outcome criteria, and calculation formulas of outcome rates are provided in Additional file 1 (Table A1).

Process Variables: MCH Services

MCH services were categorized into screening and outreach services based on the collected municipal administrative data. Screening services included introducing the PHN in charge during handbook issuance, postpartum health checkup programs, and use of the Japanese version of the Edinburgh Postnatal Depression Scale (EPDS) [25]. Postpartum health checkups are conducted at medical institutions and are not directly provided by municipalities. However, considering that they are conducted in cooperation with municipalities, they were treated as a screening service. Outreach services focused on the eligibility and timing of home visits. A comprehensive list of these variables and their binary scoring methods is detailed in Additional file 2 (Table A2).

Regional Characteristics (Structure)

To account for regional attributes, multivariate analyses were adjusted for total population, taxable income, and the proportion of low-birth-weight (LBW) infants [20, 26]. Additionally, the number of PHNs working in MCH per 10,000 population was included as a key structural variable [27]. Data were linked using municipality codes as the key variable, sourced from the 2020 National Census, Health Administration Reports, and Vital Statistics (FY2019–2022). Specific definitions and data sources are summarized in Additional file 3 (Table A3).

The proportion of LBW infants was calculated based on birth statistics. In accordance with the Statistics Act, permission to use the data was obtained from the Ministry of Health, Labor and Welfare, and data from 2019–2022 birth statistics surveys were acquired. These data were independently compiled and processed; they differ from the statistics created and published by the Ministry of Health, Labor and Welfare. Aggregate data for the period 2019–2022 were employed to stabilize birth rates in local authorities characterized by low annual birth rates. The dataset was created by linking the collected municipal administrative data and open data, with the municipality code as the key variable.

Statistical analyses

A generalized linear model was developed with abuse indicators as the dependent variables and adjustment and process variables as the independent variables. The impact of multicollinearity was assessed using variance inflation factors (VIFs) of < 5 as criteria. Statistical assumptions were confirmed as follows. Histograms of the rate of "Absence of signs of abuse" for each municipality were examined; the distribution showed a significant concentration at 100%, indicating a ceiling effect. Given that the variance of each outcome exceeded the mean, overdispersion was confirmed. The likelihood ratio test further indicated that the negative binomial regression model provided a significantly better fit than the Poisson regression model ($p < 0.05$). To account for variations in municipality size and number of respondents, the total number of respondents was included as an offset variable to calculate incidence rate ratios (IRRs). Data management was performed using Stata 18 (Stata Corp LLC, College Station, TX, USA), whereas descriptive statistics were analyzed using JMP Student Edition (SAS Institute, Cary, NC, USA). The statistical significance level was set at 5% (two-tailed).

Results

Descriptive statistics

Table 1 lists the basic attributes of the target municipalities. The municipal size distribution was as follows: government-designated cities and core cities (6.7%), general cities (44.1%), and towns and villages (49.2%). This was not significantly different from the national distribution. The birth rate per 1,000 population was 5.4 ± 1.7, the number of PHNs per 10,000 population was 6.6 ± 5.7, and the number of PHNs specializing in MCH per 10,000 population was 2.5 ± 2.6. However, all included a minimum value of 0, and the maximum values showed significant variation, ranging from 23.8–47.6. Furthermore, the proportions of LBW infants and SEMs and the rate of pregnant women requiring support (excluding SEMs) also included a minimum value of 0. The rate of pregnant women requiring support (excluding SEMs) was 11.8 ± 15.2.

Table 1
Municipal structures

Variable Name	N	Rate(%)	Mean	SD	Min	Max	Med	IQR
Municipal size								
Ordinance-designated cities and core cities	16	6.72%						
General cities	105	44.12%						
Villages and towns	117	49.16%						
Structure								
Population			66649.2	106682	420	642907	26409	67650.8
Taxable income (thousand yen)			2888.4	448.8	2160.4	5533.6	2780.6	489.8
Birth rate per 1,000 population			5.4	1.7	2.1	16.7	5.4	2.0
Number of PHNs per 10,000 population			6.6	5.7	0	47.6	4.7	4.3
Number of PHNs for MCH per 10,000 population			2.5	2.6	0	23.8	1.6	2.0
Prevalence of LBW infants per all births (%) [a]			9.5	2.2	0	18.0	9.3	1.6
Number of SEMs per 1,000 pregnancy registrations			3.9	6.2	0	48.4	1.9	3.8
Number of pregnant women requiring support (excluding SEMs) per 1,000 pregnancy			11.8	15.2	0	101.9	6.4	16.2

Abbreviations: PHN, public health nurse; SEM, specified expectant mother; LBW, low birth weight; SD, Standard Deviation; IQR, Interquartile Range

The total population and taxable income (thousand yen) were obtained from the 2020 National Census via open e-Stat resources. Birth rate, number of public health nurses, prevalence of low birth weight infants, number of pregnant women requiring support, and pregnant women requiring support (excluding SEMs) were calculated using aggregate data from 2019 to 2022.

[a]LBW was defined as a birth weight < 2,500 g

Variable Name	N	Rate(%)	Mean	SD	Min	Max	Med	IQR
registrations								
Abbreviations: PHN, public health nurse; SEM, specified expectant mother; LBW, low birth weight; SD, Standard Deviation; IQR, Interquartile Range								
The total population and taxable income (thousand yen) were obtained from the 2020 National Census via open e-Stat resources. Birth rate, number of public health nurses, prevalence of low birth weight infants, number of pregnant women requiring support, and pregnant women requiring support (excluding SEMs) were calculated using aggregate data from 2019 to 2022.								
[a]LBW was defined as a birth weight < 2,500 g								

{Insert Table 1 here}

Table 2 shows the MCH services corresponding to each outcome indicator (occurrence of abuse signs) and the process indicators. The primary outcome indicator, “Absence of abuse signs,” had an incidence of 90.56 ± 11.2%, whereas psychological and physical abuse signs were identified in 4.07 ± 2.7% and 0.67 ± 0.7% of responses, respectively. Regarding process indicators, 208 (87.4%) municipalities introduced the PHN in charge at the time of MCH handbook issuance. Regarding the criteria for identifying pregnant women requiring support, 46.6% of the municipalities had criteria for SEMs, whereas only 33.6% had support decision criteria for pregnant women requiring support (excluding SEMs). Both the maternal and newborn home visit system and the EPDS screening system had implementation rates exceeding 80%. The timing of newborn visits was within 28 days in 45.4% of cases. Cross-tabulation of process indicators (various MCH services) against outcome indicators (incidence of various signs of abuse) showed significant differences. Municipalities that conduct home visits for pregnant women had a significantly lower rate of abuse signs compared to municipalities that do not ($p < 0.05$). The incidence rate of psychological abuse signs was significantly lower in municipalities that used the "EPDS screening criteria: 9 points or higher" compared to municipalities that did not ($p < 0.01$). The incidence rate of physical abuse signs was significantly higher in municipalities that adopted the "Support decision criteria for pregnant women requiring support (excluding SEMs)" than in municipalities that did not ($p < 0.05$).

Table 2
Descriptive statistics (maternal and child health program structure by municipality)

		Distribution of municipalities N = 238		**Occurrence rate (%)**		
		Absence of abuse signs	Psychological abuse signs	Physical abuse signs	n	%
Mean ± SD				90.56 ± 11.2	4.07 ± 2.7	0.67 ± 0.7
Variable name						
Introduction of the PHN in charge at MCH Handbook Issuance	None	30	12.6	92.11	3.40	0.59
	Available	208	87.4	90.33	4.16	0.69
Support decision criteria for SEMs	None	127	53.4	90.46	4.00	0.63
	Available	111	46.6	90.67	4.14	0.73
Support decision criteria for pregnant women requiring support (excluding SEMs)	None	158	66.4	90.27	3.89	0.60
	Available	80	33.6	91.13	4.42	0.82
Home visits for pregnant women	None	9	3.8	90.91	4.10	0.67
	Available	229	96.2	81.54	3.24	0.83
Eligibility for newborn home visits	All visits	195	81.9	90.10	4.09	0.71
	As needed	43	18.1	92.64	3.96	0.55
Timing of newborn visits	> 28 days	130	54.6	90.30	3.95	0.74
	≤ 28 days	108	45.4	90.86	4.21	0.60
Postpartum health checkup program	None	47	19.8	89.71	4.28	0.69
	Available	191	80.3	90.77	4.01	0.68
EPDS implementation in MCH programs	None	33	13.9	87.08	4.91	0.70
	Available	205	86.1	91.12	3.93	0.67
EPDS screening criteria: ≥ 9 points	None	24	10.1	90.44	5.51	0.61
	Available	214	89.9	90.57	3.90	0.69

Abbreviations: MCH, maternal and child health; PHN, public health nurse; SEM, specified expectant mother; EPDS, Edinburgh Postnatal Depression Scale

[a] Implementation in MCH Programs other than postpartum checkups

Significance: Student's t-test * $p < 0.05$ ** $p < 0.01$

{Insert Table 2 here}

Impact of maternal and child health services on early signs of child abuse

The VIF was < 4 in each of the multiple regression models, indicating no multicollinearity. In Model 1, absence of abuse signs was analyzed as the dependent variable (Table 3). Results of multivariate analysis adjusted for population, taxable income (thousand yen), prevalence of LBW infants per all births (%), and number of PHNs for MCH per 10,000 population showed that the “Postpartum health checkup program” had an IRR = 1.024 (p = 0.012). As in the univariate analysis, the proportion of parents showing absence of abuse signs was significantly higher among those who underwent the "postpartum health checkup program" than among those who did not. “Home visits for pregnant women” showed a positive trend, but it was not statistically significant. While univariate analysis revealed a significant association between the absence of abuse signs and "EPDS Implementation in MCH Programs (Other Than Postpartum Checkups)," no significant association was observed in the multivariate analysis. The "support decision criteria for pregnant women requiring support (excluding SEMs)" showed a negative trend that did not reach statistical significance.

Table 3
Relationship between maternal and child health programs implemented by municipalities and the occurrence of infant abuse signs

Variable name		Model 1: Absence of abuse signs			Model 2: Psychological abuse signs			Model 3: Physical abuse signs		
		IRR	95%CI	P-value	IRR	95%CI	P-value	IRR	95%CI	P-value
Structure										
Population		1.000	1.00–1.00	0.215	1.000	1.00–1.00	0.185	1.000	1.00–1.00	0.671
Taxable income		1.000	1.00–1.00	0.309	1.000	1.00–1.00	0.003	1.000	1.00–1.00	0.146
Prevalence of LBW infants per all births (%)		1.002	1.00–1.00	0.557	1.021	0.98–1.06	0.294	1.000	0.93–1.07	0.899
Number of PHNs for MCH per 10,000 population		0.998	0.99-1.00	0.581	1.013	0.97–1.05	0.526	1.070	1.00-1.14	0.037
Process										
Introduction of the PHN in charge at MCH Handbook Issuance	None	reference			reference			reference		
	Available	0.991	0.97–1.01	0.367	1.260	1.03–1.54	0.022	1.239	0.91–1.68	0.171
Support decision criteria for SEMs	None	reference			reference			reference		
	Available	1.001	0.99–1.01	0.937	0.995	0.87–1.14	0.943	1.037	0.85–1.26	0.716
Support decision criteria for pregnant women requiring support (excluding SEMs)	None	reference			reference			reference		
	Available	0.987	0.97-1.00	0.069	1.131	0.99–1.30	0.077	1.235	1.01–1.51	0.040
Home visits for pregnant women	None	reference			reference			reference		
	Available	1.044	1.00-1.10	0.074	1.082	0.74–1.58	0.682	0.684	0.38–1.22	0.197
Eligibility for newborn home	All visits	reference			reference			reference		

Abbreviations: LBW, low birth weight; MCH, maternal and child health; PHN, public health nurse; SEM, specified expectant mother

[a] Implementation in MCH Programs other than postpartum checkups

Variable name		Model 1: Absence of abuse signs			Model 2: Psychological abuse signs			Model 3: Physical abuse signs		
		IRR	95%CI	P-value	IRR	95%CI	P-value	IRR	95%CI	P-value
visits	As needed	1.000	0.99–1.02	0.968	1.095	0.96–1.26	0.193	0.958	0.78–1.18	0.685
Timing of newborn visits	> 28 days	reference			reference			reference		
	≤ 28 days	0.995	0.98–1.01	0.536	1.063	0.90–1.25	0.461	1.223	0.96–1.56	0.102
Postpartum health checkup program	None	reference			reference			reference		
	Available	1.024	1.01–1.04	0.012	0.931	0.79–1.10	0.389	0.851	0.66–1.09	0.203
EPDS implementation in MCH programs	None	reference			reference			reference		
	Available	1.009	0.99–1.03	0.446	0.888	0.73–1.08	0.244	1.035	0.76–1.41	0.830
EPDS screening criteria: ≥9 points	None	reference			reference			reference		
	Available	1.018	0.99–1.05	0.193	0.706	0.56–0.89	0.003	0.909	0.63–1.31	0.612

Abbreviations: LBW, low birth weight; MCH, maternal and child health; PHN, public health nurse; SEM, specified expectant mother

[a] Implementation in MCH Programs other than postpartum checkups

In Model 2, psychological abuse signs were analyzed as the dependent variable (Table 3). Multivariate analysis results showed that “introduction of the PHN in charge at MCH handbook issuance” was associated with a significantly higher proportion of parents identified with psychological abuse signs than was “no introduction” (IRR = 1.260, p = 0.022). Conversely, “EPDS screening score of ≥ 9” had an IRR of 0.706 (p = 0.003), indicating a lower incidence of psychological abuse signs. These associations were in the same direction as those identified in the univariate analysis. Furthermore, compared with “no criteria,” “support decision criteria for pregnant women requiring support (excluding SEMs)” tended to be associated with a higher proportion of parents identified with psychological abuse signs, although the difference was not statistically significant.

In Model 3, physical abuse signs were analyzed as the dependent variable (Table 3). Multivariate analysis revealed significant differences in structure indicators. The proportion of parents identified with physical abuse signs was significantly higher in municipalities with more MCH nurses (IRR = 1.070, p = 0.037).

Furthermore, regarding process indicators, municipalities with “support decision criteria for pregnant women requiring support (excluding SEMs)” had a significantly higher proportion of parents identified with physical abuse signs than were those without such criteria (IRR = 1.235, p = 0.040).

{Insert Table 3 here}

Discussion

This ecological study analyzed the relationship between MCH policies implemented at the local government level in Japan and the occurrence of abuse signs in 3–4-month-old infants. Accordingly, several key findings were identified: first, postpartum health checkup programs, and the establishment of EPDS screening criteria (≥ 9 points)—as well as home visits for pregnant women, although not statistically significant at the 5% level—were may be associated with a lower incidence of signs of abuse. Second, it was suggested that clearly introducing the role of PHNs as support providers at MCH handbook issuance, ensuring a sufficient number of PHNs responsible for MCH, and applying support decision criteria for pregnant women requiring support (excluding SEMs) may contribute to the detection of often overlooked signs of abuse.

MCH services provided during pregnancy and in the early postnatal period potentially contribute to mitigating child abuse

The findings of this study indicate that home visits to pregnant women—an outreach activity conducted during pregnancy—and postpartum health checkup programs conducted at maternity hospitals approximately 1 month after childbirth were potentially associated with absence of abuse signs. These results suggest that early outreach support may reduce the risk of abuse. Early home visits, including during pregnancy, have been reported to contribute to high satisfaction with the care provided and positive empowerment. Support for both mothers and fathers has been reported to improve positive parenting attitudes up to the age of 4 years, demonstrating the effectiveness of early intervention [28]. The perinatal period is a time when women are particularly prone to mental health issues, with the risk being especially high during the first month after childbirth [29]; thus, support for maternal mental health is crucial for abuse prevention [30]. The present study suggests that implementing the EPDS immediately after childbirth may contribute to the early detection of child abuse. In the United States, in areas lacking mental health resources for mothers, the risk to their mental health is high, which potentially increases the risk of child abuse [31]. Therefore, support for mothers' mental health plays a crucial role in the prevention of child abuse.

In Japan, municipalities contract the postpartum health checkup program to obstetric medical institutions, allowing medical professionals to approach mothers within 1 month of birth. This early implementation of support for mothers' mental health is posited to have indirectly contributed to the absence of abuse signs. Furthermore, EPDS screening is conducted in conjunction with postpartum health checkups. The current study showed that an EPDS score of ≥ 9 points was negatively associated with the occurrence of psychological abuse indicators, making this screening criterion an important indicator for support.

Taken together, these findings suggest that strengthening outreach support during pregnancy and the early postnatal period, particularly through home visits to pregnant women and postpartum health checkups—periods when anxiety is likely to be heightened—may contribute to child abuse mitigation.

A clear supporter presence contributes to the detection of often overlooked signs of abuse

This study found that the detection of often overlooked signs of abuse was significantly increased with the "introduction of the PHN in charge at the time of MCH handbook issuance" and with the number of PHNs responsible for MCH. Early detection of abuse remains challenging. While psychological abuse is one of the most serious forms of child abuse [32], its vague definition [33] and the difficulty in identifying sporadic abusive acts

(such as hitting) stemming from parental mental health issues act as barriers to early detection and appropriate intervention by specialist agencies [33, 34].

The present study suggested that the presence of PHNs providing support to mothers and fathers, and the potential to increase their numbers, may improve the detection of often overlooked signs of child abuse. In Japan's MCH activities, PHNs identify cases at risk of abuse during pregnancy, create opportunities for individualized support, and provide long-term parenting support while anticipating situations in which abuse may be suspected [35]. PHNs have been reported to conduct interviews at the time of MCH handbook issuance to assess child abuse risk and anxieties about childcare, and to initiate necessary support [14, 15]. In other words, by being introduced to the PHN in charge when receiving their MCH handbook, mothers and fathers can become aware of the presence of local PHNs and other nursing professionals early on.

It is expected that Japan's MCH services will be restructured and expanded to address contemporary challenges [36]. Adequate staffing levels are essential to maintain high coverage rates for MCH care within local communities. The findings of the current study suggest a pressing need to ensure sufficient numbers of PHNs specializing in MCH.

Criteria for identifying those in need of support contribute to the detection of often overlooked signs of abuse

The findings of this study suggest that the criteria for identifying pregnant women in need of support (excluding SEMs) may help detect often overlooked signs of child abuse. This suggests that identifying pregnant women requiring support in the early stages of pregnancy can help establish a relationship of trust at an early stage, thereby contributing to the early detection of abuse. Nonetheless, no significant association was found between the criteria for determining support for SEMs and the absence of signs of abuse.

The eligibility criteria for "specific pregnant women" are clearly defined in the guidelines for support services for pregnant women and new mothers in Japan [12], covering factors such as poverty and unstable relationships with partners. The criteria are established at the prefectural level, and there is a system for registering with regional councils for child protection measures. Therefore, even without clear criteria at the local government level, a certain level of national standards can be maintained. However, the criteria for identifying pregnant women requiring support (excluding SEMs) lack national standards and are left to the discretion of local governments, which likely explains the observed differences between local governments.

The results of this study suggest that local government programs for identifying women with support needs during pregnancy, even if they do not meet the SEM criteria, could potentially reveal risks of child abuse.

Study limitations

This study had certain limitations warranting acknowledgement. First, the sample size was small, and the survey was limited to a specific region, thus caution is needed when generalizing the results. Second, data bias and accuracy pose issues. There is a possibility of sample bias, such as municipalities with well-established systems being more proactive in responding. Examining differences in the combination of MCH services and the timing of service utilization is necessary. Third, this was a cross-sectional study, and causality could not be established. Therefore, longitudinal studies are warranted. Finally, MCH services are structured into multilayered systems to provide seamless support; however, this was a municipal-level ecological study, and individual-level analyses are needed to enable more detailed and careful interpretation.

Study strengths

This study clarified the structure of MCH services through a field survey and quantified their contribution to identifying and addressing early signs of child abuse, an urgent and critical issue.

Conclusions

This ecological study assesses the relationship between MCH services implemented by local governments and the occurrence of signs of infant abuse, which has been insufficiently examined. The results revealed support for two hypotheses. First, the introduction of home visits to pregnant women, postpartum health checkup programs, and the establishment of EPDS screening criteria (9 points or higher) may be associated with a lower incidence of abuse signs. Second, it was suggested that clearly introducing the role of PHNs as support providers when issuing the MCH handbook, ensuring a sufficient number of PHNs responsible for MCH, and applying support decision criteria for pregnant women requiring support (excluding SEMs) may contribute to the detection of often overlooked signs of abuse.

These findings highlight the importance of enhanced multi-layered maternal and child health services and the deployment of public health nurses in contributing to the early detection of abuse.

Abbreviations

EPDS: Edinburgh Postnatal Depression Scale

IRR: Incidence rate ratio

LBW: Low birth weight

MCH: Maternal and child health

PHN: Public health nurse

SEM: Specified Expectant Mother

VIF: Variance inflation factor

Declarations

Ethics approval and consent to participate

Ethical approval for this study was obtained from the Ethics Review Committees of Shiga University of Medical Science (R2023-111) and Clinical Research of Kyoto University (023-01303). The study was conducted in accordance with the ethical principles of the Declaration of Helsinki for medical research involving human participants. Before data collection, informed consent was obtained from all participants. The participants were assured of the confidentiality of their responses and their right to withdraw from the study at any time without any consequences.

Human Ethics and Consent to Participate declarations

Not applicable.

Consent for publication

Not applicable.

Availability of data and materials

Some of the data used in this study are publicly available on the Japanese government statistics portal site https://www.e-stat.go.jp/. Other data collected and analyzed in this study are available from the corresponding author upon reasonable request.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

ST: Conceptualization, methodology, formal analysis, manuscript preparation, funding acquisition. MS: Conceptualization, Methodology, Formal Analysis, Peer Review & Editing, Funding Acquisition. MI: Conceptualization, Methodology, Formal Analysis, Peer Review & Editing, Funding Acquisition. TK: Conceptualization, Methodology, Formal Analysis, Peer Review & Editing, Funding Acquisition.

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Authors' information:

ST; Kyoto Koka University, Kyoto, Japan

ST and MS; Human Health Sciences, Graduate School of Medicine, Kyoto University, Kyoto, Japan

ST and MI; Shiga University of Medical Science, Shiga, Japan

KT; Center for Quantum Information and Quantum Biology, The University of Osaka, Japan

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Figures

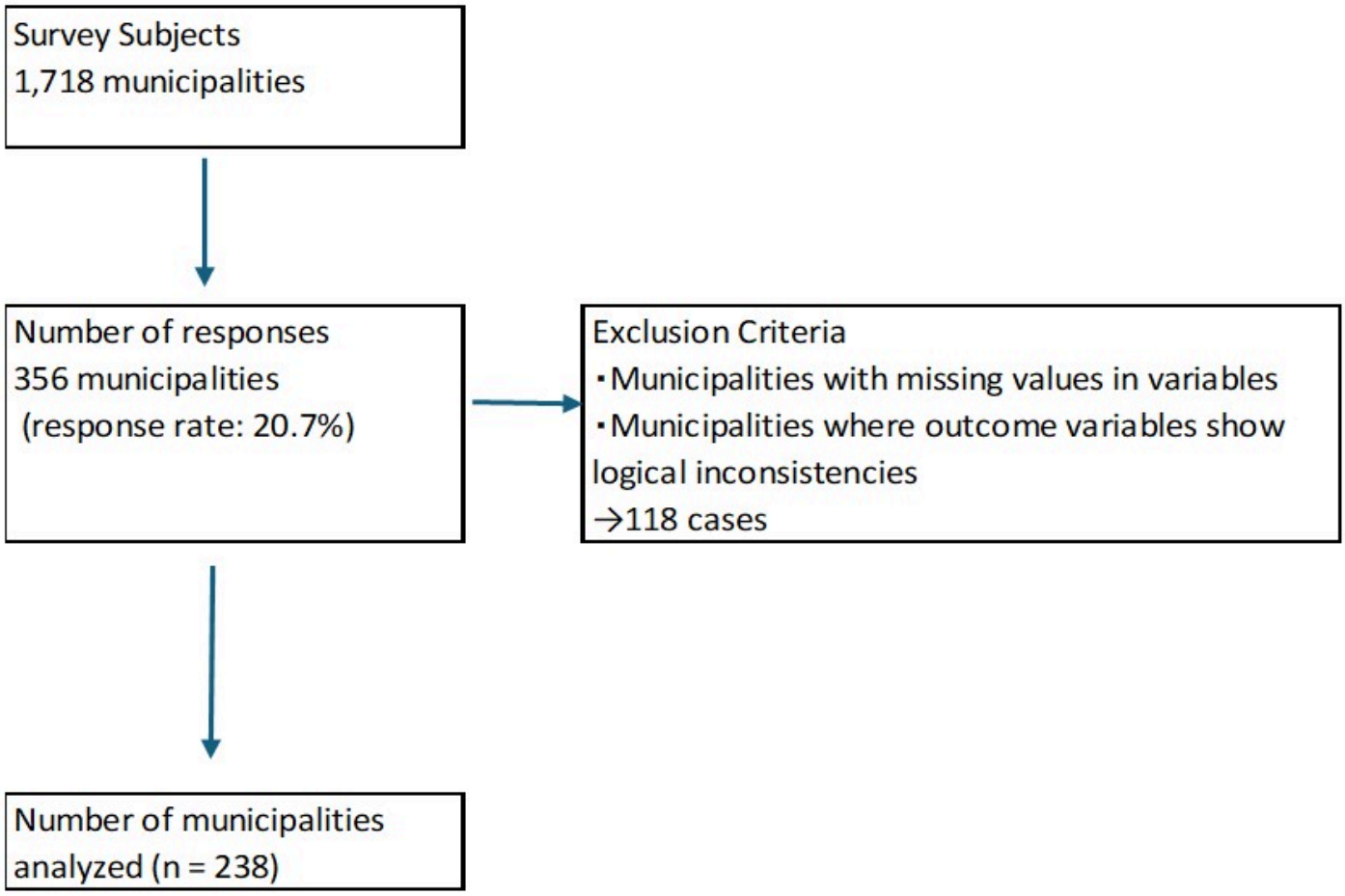


Figure 1

Flowchart for selecting analysis targets

Abbreviations: MCH, maternal and child health; PHN, public health nurse; SEM, specified expectant mother; EPDS, Edinburgh Postnatal Depression Scale

The analytical framework referenced the Donabedian model [23], consisting of structure, process, and outcome. We examined the relationship between MCH systems (process) and the occurrence of signs of abuse (outcome), while adjusting for regional characteristics (structure).

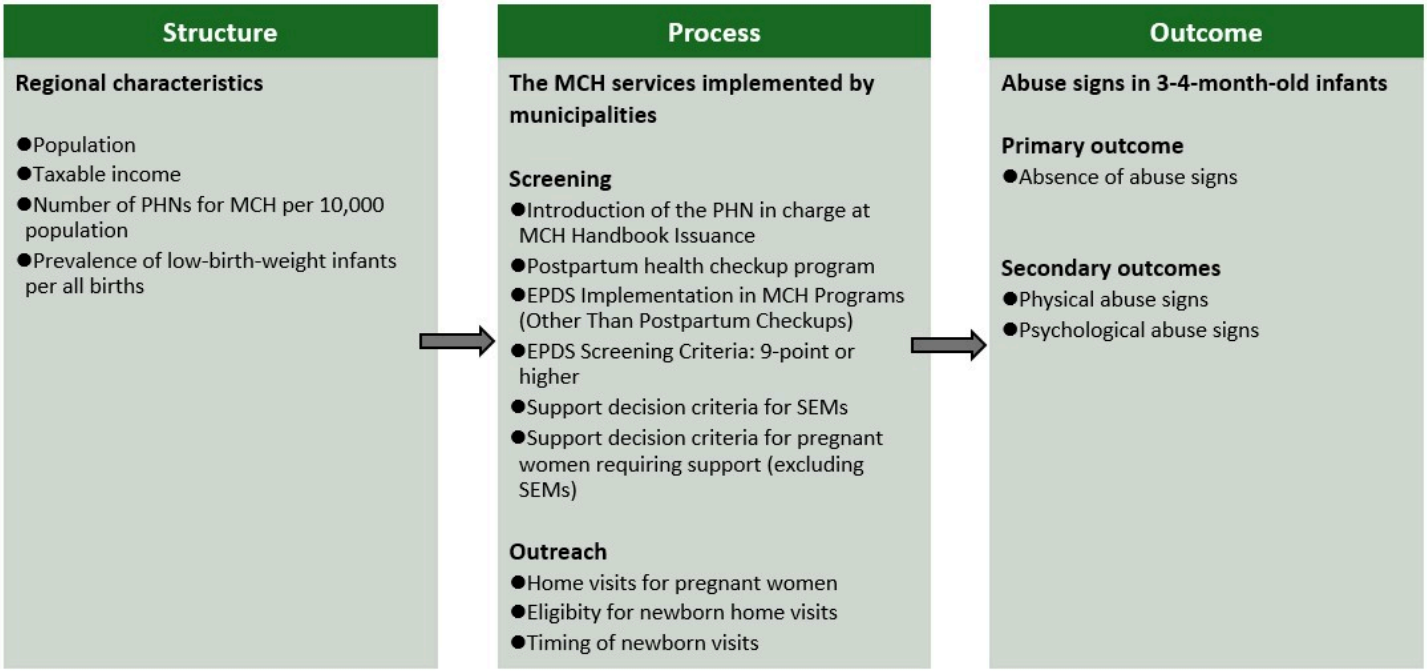


Figure 2

Conceptual framework

"Implementation Status of Maternal and Child Health Services" was mailed to the 1,718 municipalities in Japan as of 2023, and that the 356 responses were obtained between February 27 and June 26, 2024. Ultimately, 238 municipalities were included in the final analysis.

Supplementary Files

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