

# BMJ Open Association of socioeconomic factors and the risk for unintentional injuries among children in Japan: a cross-sectional study

Nobuhiro Sato,<sup>1</sup> Yusuke Hagiwara,<sup>2</sup> Junta Ishikawa,<sup>1</sup> Kohei Akazawa<sup>1</sup>

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<sup>1</sup>Department of Medical Informatics and Statistics, Niigata University Graduate School of Medicine, Niigata, Japan

<sup>2</sup>Department of Pediatric Emergency and Critical Care Medicine, Tokyo Metropolitan Children's Medical Center, Tokyo, Japan

## Correspondence to

Dr Nobuhiro Sato;  
[s\\_nobuhiro@hosp.niigata.niigata.jp](mailto:s_nobuhiro@hosp.niigata.niigata.jp)

## ABSTRACT

**Objectives** While Japan has socioeconomic issues, such as income inequality, little is known about the association between socioeconomic factors and the risk of unintentional childhood injuries. The purpose of the study was to evaluate the influence of socioeconomic factors on the risk for unintentional injuries among preschool children in Japan.

**Design** Cross-sectional study using data from a web-based questionnaire survey.

**Setting** Japan (January 2015).

**Participants** 1000 households with preschool children under 6 years of age.

**Outcome measures** Multivariate logistic regression was performed to analyse the influence of socioeconomic factors on the incidence of unintentional injuries.

**Results** Overall, 976 households were eligible for the analysis, with 201 households reporting unintentional injuries. The incidence rates for unintentional injury were estimated to be constant across all strata constructed using combinations of socioeconomic factors. The multivariate logistic regression analysis showed no significant differences in socioeconomic factors between households that reported unintentional injuries and those that did not.

**Conclusion** The findings of our study demonstrated that unintentional injuries among preschool children occurred at approximately fixed rates, independent of socioeconomic factors. Accordingly, prevention strategies for unintentional injuries that concern socioeconomic disadvantages should be avoided in Japan.

## INTRODUCTION

Unintentional injuries are a leading cause of death among children of all ages.<sup>1–4</sup> The term ‘unintentional injury’ in this context is defined as an injury that is not inflicted deliberately; the injury may have been caused by a fall, poisoning, drowning, burns or traffic-related accidents. Globally, unintentional injuries accounted for 15.4% of approximately 2.6 million deaths recorded for children aged 1 to 14 years in 2013.<sup>1</sup> In particular, children aged 1 to 4 years demonstrate the highest all-cause and cause-specific mortality

## Strengths and limitations of this study

- A nationwide questionnaire survey administered in Japan.
- 1000 households with a population distribution similar to that in the national census were included.
- Confounders by unmeasured factors, such as physical disabilities in children, are study limitations.

rates due to unintentional injuries.<sup>1</sup> The risks for unintentional injuries among children are mainly defined by individual factors (behaviours and attributes), the presence or absence of supervision and safety equipment and vehicle safety.<sup>5</sup> Moreover, the risks can be influenced by socioeconomic factors, including family income, parental education, single parenting, maternal age, older siblings and type of housing.<sup>6–13</sup> In fact, Laursen *et al* reported that children with young mothers and mothers with only primary school education were at higher risk for most types of injuries than other children in Denmark.<sup>10</sup>

Similarly, in Japan, unintentional injuries have been a major cause of death among children aged ≥1 year since 1960.<sup>14,15</sup> Furthermore, several socioeconomic issues exist in Japan. For example, Japan is ranked fourth highest for income inequality across the Organisation for Economic Cooperation and Development member countries.<sup>16</sup> The relative poverty rate for households with children was 12.9% in 2015.<sup>17</sup> A previous study revealed the association between socioeconomic inequality and the risk for infant abuse in Japan.<sup>18</sup> However, only a few studies have examined the relationship between socioeconomic status and unintentional injury among children in Japan thus far.

The purpose of this study was to evaluate the influence of socioeconomic factors on

the risk for unintentional injuries among children in Japan via a nationwide questionnaire survey.

## METHODS

### Study design and participants

This study involved a web-based questionnaire survey. The participants were selected in January 2015 from a database of 1 370 000 candidates compiled by a private Japanese company specialising in questionnaire-based research. We extracted data for 1000 households with preschool children under 6 years of age. All participants lived in Japan. Region was used as a variable for stratified random sampling. Hence, the region-wise distribution of our sample was almost identical to that of the general population in Japan. All respondents completed the questionnaire on a website developed specially for this study by the survey company. Exclusion criteria included

**Table 1** Characteristics of 976 households with preschool children under 6 years old

Factors	n=976	%
<b>Respondent</b>		
Mother	569	58.3
Father	407	41.7
<b>Region</b>		
Urban area	678	69.5
Others	298	30.5
<b>Family type</b>		
Two parents	936	95.9
Single parent	40	4.1
<b>Number of children</b>		
1	375	38.4
2	447	45.8
≥3	154	15.8
<b>Living with grandparent</b>		
Yes	389	39.9
No	587	60.1
<b>Use of sitter, kindergarten or nursery school</b>		
Yes	197	20.2
No	779	79.8
<b>Type of housing</b>		
House	516	52.9
Apartment	460	47.1
<b>Annual income</b>		
<3 million	117	12.0
3–5 million	366	37.5
>5 million	493	50.5
<b>Unintentional injury</b>		
Yes	201	20.6
No	775	79.4

not living with parents; missing information regarding parent education and type of housing; and children being cared for by people other than the parents, grandparents, kindergarten teachers and nursery teachers during the daytime. An urban area was defined as an area with >15 million residents. Returning the questionnaire was taken as agreement to participate in the study and informed consent was obtained from all participants.

### Measures

The questionnaire included 20 questions about basic and socioeconomic characteristics and 17 questions concerning unintentional injuries. The following socioeconomic factors were used for evaluation: father's age; mother's age; living area; number of siblings; highest education levels of parents; annual income of parents; type of housing; parents' employment status; living with grandparents; primary caregiver during the daytime and at night; use of a sitter, kindergarten or nursery school; and history of injuries. Parents were divided into three groups according to the mean age of mothers (30.7 years old) at the birth of the first child in Japan: ≤29 years, 30–39 years and ≥40 years.<sup>15</sup> Highest education level was classified as junior high school or high school, business

**Table 2** Distribution of 201 unintentionally injured children by injury-descriptive factors

Factors	n=201	%
<b>Injury mechanism (multiple answers)</b>		
Fall	117	58.2
Burn	47	23.4
Poisoning/Aspiration	12	6.0
Drowning	6	3.0
Traffic injury	7	3.5
Others	12	6.0
<b>Gender of child</b>		
Male	119	59.2
Female	82	40.8
<b>Time of injury</b>		
Daytime on a weekday	106	52.7
Night-time on a weekday	64	31.8
Holiday	31	15.4
<b>Place of injury</b>		
Home	188	93.5
Outdoor	13	6.5
<b>Witnessed by caregivers</b>		
Yes	129	64.2
No	72	35.8
<b>Management after injury</b>		
Visit hospital	112	55.7
Observation at home	88	43.8
Others	1	0.5

**Table 3** Unadjusted risk for unintentional injuries among children and socioeconomic factors

Unintentional injury																
Factors	Overall (n=976)	Fall	%*	Burn	%*	Poisoning/Aspiration	%*	Drowning	%*	Traffic injury	%*	Others	%*	Total	%*	P values†
		(n=117)	(n=47)	(n=12)	(n=6)	(n=7)	(n=12)	(n=6)	(n=7)	(n=12)	(n=201)					
Family type																p=0.372
Two parents	936	112	12.0	47	5.0	12	1.3	6	0.6	6	0.6	12	1.3	195	20.8	
Single parent	40	5	12.5	0	0.0	0	0.0	0	0.0	1	2.5	0	0.0	6	15.0	p=0.635
Age of mother																
<29 years	109	15	13.8	5	4.6	0	0.0	4	3.7	0	0.0	2	1.8	26	23.9	
30–39 years	579	64	11.1	28	4.8	8	1.4	2	0.3	5	0.9	8	1.4	115	19.9	
≥40 years	288	38	13.2	14	4.9	4	1.4	0	0.0	2	0.7	2	0.7	60	20.8	
Age of father																p=0.940
<29 years	68	9	13.2	3	4.4	0	0.0	1	1.5	0	0.0	1	1.5	14	20.6	
30–39 years	462	55	11.9	22	4.8	6	1.3	3	0.6	2	0.4	5	1.1	93	20.1	
≥40 years	446	53	11.9	22	4.9	6	1.3	2	0.4	5	1.1	6	1.3	94	21.1	
Education of mother																p=0.160
High school	277	33	11.9	15	5.4	2	0.7	2	0.7	2	0.7	4	1.4	58	20.9	
Business technical school or junior college	351	48	13.7	22	6.3	3	0.9	1	0.3	4	1.1	4	1.1	82	23.4	
College	348	36	10.3	10	2.9	7	2.0	3	0.9	1	0.3	4	1.1	61	17.5	
Education of father																p=0.200
High school	281	39	13.9	20	7.1	3	1.1	1	0.4	3	1.1	2	0.7	68	24.2	
Business technical school or junior college	150	20	13.3	6	4.0	2	1.3	0	0.0	0	0.0	2	1.3	30	20.0	
College	545	58	10.6	21	3.9	7	1.3	5	0.9	4	0.7	8	1.5	103	18.9	
Number of children																p=0.138
1	375	44	11.7	11	2.9	3	0.8	2	0.5	1	0.3	4	1.1	65	17.3	
2	447	53	11.9	26	5.8	7	1.6	4	0.9	4	0.9	7	1.6	101	22.6	
≥3	154	20	13.0	10	6.5	2	1.3	0	0.0	2	1.3	1	0.6	35	22.7	
Infant (<1 year old)																p=0.403
Yes	170	19	11.2	6	3.5	3	1.8	2	1.2	0	0.0	1	0.6	31	18.2	
No	806	98	12.2	41	5.1	9	1.1	4	0.5	7	0.9	11	1.4	170	21.1	

Continued

**Table 3** Continued

Unintentional injury																			
Factors	Overall (n=976)	Fall (n=117)			Burn (n=47)			Poisoning/Aspiration (n=12)			Drowning (n=6)			Traffic injury (n=7)			Others (n=12)	Total (n=201)	P value†
		n	%*	%*	n	%*	%*	n	%*	%*	n	%*	%*	n	%*	%*			
Older siblings (>6 years old)																			
Yes	374	47	12.6	22	5.9	5	1.3	1	0.3	4	1.1	4	1.1	4	1.1	83	22.2	p=0.330	
No	602	70	11.6	25	4.2	7	1.2	5	0.8	3	0.5	8	1.3	118	19.6				
Living with grandmother																			
Yes	128	14	10.9	7	5.5	0	0.0	1	0.8	1	0.8	3	2.3	26	20.3	p=0.933			
No	848	103	12.1	40	4.7	12	1.4	5	0.6	6	0.7	9	1.1	175	20.6				
Living with grandfather																			
Yes	362	47	13.0	19	5.2	4	1.1	2	0.6	1	0.3	6	1.7	79	21.8	p=0.466			
No	614	70	11.4	28	4.6	8	1.3	4	0.7	6	1.0	6	1.0	122	19.9				
Mother's employment status																			
Employed	391	52	13.3	19	4.9	3	0.8	1	0.3	4	1.0	5	1.3	84	21.5	p=0.574			
Unemployed	585	65	11.1	28	4.8	9	1.5	5	0.9	3	0.5	7	1.2	117	20.0				
Father's employment status																			
Employed	964	114	11.8	47	4.9	12	1.2	6	0.6	7	0.7	12	1.2	198	20.5	p=0.463			
Unemployed	12	3	25.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	3	25.0				
Use of sitter, kindergarten or nursery school																			
Yes	197	32	16.2	9	4.6	2	1.0	0	0.0	2	1.0	3	1.5	48	24.4	p=0.143			
No	779	85	10.9	38	4.9	10	1.3	6	0.8	5	0.6	9	1.2	153	19.6				
Type of housing																			
House	516	66	12.8	28	5.4	2	0.4	2	0.4	4	0.8	8	1.6	110	21.3	p=0.554			
Apartment	460	51	11.1	19	4.1	10	2.2	4	0.9	3	0.7	4	0.9	91	19.8				
Annual income																			
<3 million	117	15	12.8	5	4.3	2	1.7	0	0.0	1	0.9	2	1.7	25	21.4	p=0.855			
3–5 million	366	48	13.1	17	4.6	2	0.5	4	1.1	2	0.5	5	1.4	78	21.3				
>5 million	493	54	11.0	25	5.1	8	1.6	2	0.4	4	0.8	5	1.0	98	19.9				

\*The proportion of the number of unintentional injuries to the overall number of each socioeconomic factor.

†The Pearson's  $\chi^2$  test or Fisher's exact test for total number of unintentional injuries.

**Table 4** Time of unintentional injuries among children and socioeconomic factors

Factors	Unintentional injury								
	Overall (n=976)	Daytime on a weekday (n=106)	%*	Night- time on a weekday (n=64)	%*	Holiday (n=31)	%*	Total (n=201)	%*
<b>Family type</b>									
Two parents	936	102	10.9	62	6.6	31	3.3	195	20.8
Single parent	40	4	10.0	2	5.0	0	0.0	6	15.0
<b>Age of mother</b>									
<29 years	109	14	12.8	8	7.3	4	3.7	26	23.9
30–39 years	579	65	11.2	32	5.5	18	3.1	115	19.9
≥40 years	288	27	9.4	24	8.3	9	3.1	60	20.8
<b>Age of father</b>									
<29 years	68	9	13.2	4	5.9	1	1.5	14	20.6
30–39 years	462	52	11.3	26	5.6	15	3.2	93	20.1
≥40 years	446	45	10.1	34	7.6	15	3.4	94	21.1
<b>Education of mother</b>									
High school	277	29	10.5	20	7.2	9	3.2	58	20.9
Business technical school or junior college	351	43	12.3	25	7.1	14	4.0	82	23.4
College	348	34	9.8	19	5.5	8	2.3	61	17.5
<b>Education of father</b>									
High school	281	34	12.1	22	7.8	12	4.3	68	24.2
Business technical school or junior college	150	19	12.7	8	5.3	3	2.0	30	20.0
College	545	53	9.7	34	6.2	16	2.9	103	18.9
<b>Number of children</b>									
1	375	37	9.9	19	5.1	9	2.4	65	17.3
2	447	50	11.2	34	7.6	17	3.8	101	22.6
≥3	154	19	12.3	11	7.1	5	3.2	35	22.7
<b>Infant (&lt;1 year old)</b>									
Yes	170	23	13.5	7	4.1	1	0.6	31	18.2
No	806	83	10.3	57	7.1	30	3.7	170	21.1
<b>Older siblings (&gt;6 years old)</b>									
Yes	374	43	11.5	24	6.4	16	4.3	83	22.2
No	602	63	10.5	40	6.6	15	2.5	118	19.6
<b>Living with grandmother</b>									
Yes	128	13	10.2	7	5.5	6	4.7	26	20.3
No	848	93	11.0	57	6.7	25	2.9	175	20.6
<b>Living with grandfather</b>									
Yes	362	44	12.2	26	7.2	9	2.5	79	21.8
No	614	62	10.1	38	6.2	22	3.6	122	19.9
<b>Mother's employment status</b>									
Employed	391	35	9.0	33	8.4	16	4.1	84	21.5
Unemployed	585	71	12.1	31	5.3	15	2.6	117	20.0
<b>Father's employment status</b>									
Employed	964	104	10.8	63	6.5	31	3.2	198	20.5
Unemployed	12	2	16.7	1	8.3	0	0.0	3	25.0

Continued

Table 4 Continued

Factors	Overall (n=976)	Unintentional injury							
		Daytime on a weekday (n=106)	%*	Night- time on a weekday (n=64)	%*	Holiday (n=31)	%*	Total (n=201)	%*
Use of sitter, kindergarten or nursery school									
Yes	197	16	8.1	21	10.7	11	5.6	48	24.4
No	779	90	11.6	43	5.5	20	2.6	153	19.6
Type of housing									
House	516	59	11.4	34	6.6	17	3.3	110	21.3
Apartment	460	47	10.2	30	6.5	14	3.0	91	19.8
Annual income									
<3 million	117	15	12.8	9	7.7	1	0.9	25	21.4
3–5 million	366	42	11.5	23	6.3	13	3.6	78	21.3
>5 million	493	49	9.9	32	6.5	17	3.4	98	19.9

\*The proportion of the number of unintentional injuries to the overall number of each socioeconomic factor.

technical school or junior college and college. Annual income was classified as <3 million yen, 3–5 million yen and ≥5 million yen, based on the average income in Japan (median 4.28 million yen).<sup>17</sup> Type of housing was divided into house and apartment house categories. Injury was defined as physical damage that was fatal or caused after-effects. We included the following types of injuries: all injuries, such as falls from stairs or a balcony; burns from hot liquids, hot surfaces or fire; accidental poisoning; foreign body aspiration or suffocation; drowning; and traffic injuries.<sup>10</sup> The information collected about unintentional injuries included gender of child, time, place of injury, witnessed by others or not and management after injury. The injury mechanism was defined as the injury that the respondent considered to be the most severe when the child experienced multiple unintentional injuries.

### Statistical analysis

The sample size calculation was performed on the basis of a statistical power of 80%, two-sided p value of 0.05, an event rate of 25% and a relative risk of socioeconomic disadvantage of 1.2, obtained from previous studies.<sup>8 10 19</sup>

Continuous data with skewed distributions are shown as medians and IQRs, and categorical data as proportions. The Pearson's  $\chi^2$  test or Fisher's exact test was used to explore the significance of differences between households reporting unintentional injuries and those that did not report any injuries.

Multiple logistic regression analysis was used to estimate the ORs and 95% CIs after controlling simultaneously for potential confounders. We used unintentional injury as the dependent variable. We included 15 significant risk factors in the analysis (family type, age of parents, education of parents, number of children, presence of infant or older siblings, living with grandparent, parents' employment status, use of sitter, kindergarten or nursery school,

type of housing and annual income). All statistical tests were two-sided. A p value less than 0.05 was considered statistically significant. Data analysis was performed using SPSS, V.23.0 (IBM Corporation, Armonk, New York, USA).

### Patient and public involvement

Patients and public were not involved in the design of the study.

## RESULTS

### Characteristics of the study population

Of the 1000 households that participated in this study, 24 families were excluded because of missing data regarding the parents' education (n=2), type of housing (n=17) and primary caregivers apart from parents, grandparents, kindergarten teachers and nursery school teachers during the daytime (n=5). Table 1 shows the basic characteristics of the 976 households that were included in the study. The median age of the respondents was 38 years (IQR 33–42 years). In total, 201 households reported unintentional injuries among children. Table 2 presents the distribution of the 201 unintentionally injured children according to injury-descriptive variables. The most frequently observed mechanism of injury was falls (58.2%), followed by burns (23.4%), poisoning/aspiration (6.0%), drowning (3.0%), traffic injury (3.5%) and others (6.0%).

### Risk factors for unintentional injury among preschool children in Japan

Table 3 shows the incidence rates of 15 socioeconomic factors. The incidence of unintentional injury was estimated at approximately 21% with or without the presence of socioeconomic disadvantage. The risk for unintentional

**Table 5** Management after unintentional injuries among children and socioeconomic factors

Factors	Overall (n=976)	Unintentional injury						Total (n=201)	%*
		Visit hospital (n=112)	%*	Observation at home (n=88)	%*	Others (n=1)	%*		
<b>Family type</b>									
Two parents	936	109	11.6	85	9.1	1	0.1	195	20.8
Single parent	40	3	7.5	3	7.5	0	0.0	6	15.0
<b>Age of mother</b>									
<29 years	109	8	7.3	18	16.5	0	0.0	26	23.9
30–39 years	579	63	10.9	52	9.0	0	0.0	115	19.9
≥40 years	288	41	14.2	18	6.3	1	0.3	60	20.8
<b>Age of father</b>									
<29 years	68	5	7.4	9	13.2	0	0.0	14	20.6
30–39 years	462	51	11.0	42	9.1	0	0.0	93	20.1
≥40 years	446	56	12.6	37	8.3	1	0.2	94	21.1
<b>Education of mother</b>									
High school	277	27	9.7	30	10.8	0	0.0	58	20.9
Business technical school or junior college	351	53	15.1	29	8.3	0	0.0	82	23.4
College	348	32	9.2	29	8.3	1	0.3	61	17.5
<b>Education of father</b>									
High school	281	39	13.9	28	10.0	1	0.4	68	24.2
Business technical school or junior college	150	19	12.7	11	7.3	0	0.0	30	20.0
College	545	54	9.9	49	9.0	0	0.0	103	18.9
<b>Number of children</b>									
1	375	26	6.9	38	10.1	1	0.3	65	17.3
2	447	61	13.6	40	8.9	0	0.0	101	22.6
≥3	154	25	16.2	10	6.5	0	0.0	35	22.7
<b>Infant (&lt;1 year old)</b>									
Yes	170	13	7.6	18	10.6	0	0.0	31	18.2
No	806	99	12.3	70	8.7	1	0.1	170	21.1
<b>Older siblings (&gt;6 years old)</b>									
Yes	374	55	14.7	28	7.5	0	0.0	83	22.2
No	602	57	9.5	60	10.0	1	0.2	118	19.6
<b>Living with grandmother</b>									
Yes	128	13	10.2	13	10.2	0	0.0	26	20.3
No	848	99	11.7	75	8.8	1	0.1	175	20.6
<b>Living with grandfather</b>									
Yes	362	44	12.2	35	9.7	0	0.0	79	21.8
No	614	68	11.1	53	8.6	1	0.2	122	19.9
<b>Mother's employment status</b>									
Employed	391	53	13.6	31	7.9	0	0.0	84	21.5
Unemployed	585	59	10.1	57	9.7	1	0.2	117	20.0
<b>Father's employment status</b>									
Employed	964	110	11.4	87	9.0	1	0.1	198	20.5
Unemployed	12	2	16.7	1	8.3	0	0.0	3	25.0

Continued

Table 5 Continued

Factors	Overall (n=976)	Unintentional injury							
		Visit hospital (n=112)	%*	Observation at home (n=88)	%*	Others (n=1)	%*	Total (n=201)	%*
Use of sitter, kindergarten or nursery school									
Yes	197	32	16.2	16	8.1	0	0.0	48	24.4
No	779	80	10.3	72	9.2	1	0.1	153	19.6
Type of housing									
House	516	73	14.1	37	7.2	0	0.0	110	21.3
Apartment	460	39	8.5	51	11.1	1	0.2	91	19.8
Annual income									
<3million	117	14	12.0	11	9.4	0	0.0	25	21.4
3–5million	366	36	9.8	41	11.2	1	0.3	78	21.3
>5million	493	62	12.6	36	7.3	0	0.0	98	19.9

\*The proportion of the number of unintentional injuries to the overall number of each socioeconomic facto.

injuries was higher among preschool children with high-school graduate fathers and those in families with more siblings. However, there were no significant differences in incident rates of unintentional injuries across all groups. Table 4 shows the association between socioeconomic factors and timing of injury. Table 5 shows the association between socioeconomic factors and management after injury. Consistent with the main results, there was no relationship between socioeconomic factors and the variables in these tables.

The results of the multivariate analysis are shown in table 6. Between households reporting unintentional injuries and those that did not report any, no significant differences in terms of income of parents were observed in the incident rates of unintentional injuries among preschool children (adjusted OR 0.90; 95% CI 0.53 to 1.53;  $p=0.701$ ). Similarly, there were no significant differences in the other socioeconomic factors in terms of the incident rates of unintentional injuries among preschool children.

## DISCUSSION

Herein, we observed that unintentional injuries among preschool children under 6years old occurred at approximately constant rates and were unrelated to any socioeconomic factors in Japan. Socioeconomic disadvantages did not significantly increase the risk for unintentional injuries among preschool children.

Our data showed that households whose annual income was under 3 million yen accounted for 12.0% of the population, whereas the relative poverty rate for households with children was 12.9% in Japan.<sup>17</sup> The incidence rate of unintentional injuries observed in our study is not very different from that reported in other studies: 29.0 injuries per 100 children over a period of 1 year within a population of 0–4-year-old children in a Greek town

and 17.4 medically treated injuries within a population of 0–4-year-old children and adolescents in a health maintenance organisation.<sup>8 19</sup>

Nevertheless, our results differ from the outcomes reported in other studies of the relationship between unintentional injuries and socioeconomic factors.<sup>7 10 12</sup> There are several explanations for these results. First, the younger age of children may affect the relationship between the risk for unintentional injuries and socioeconomic factors. A previous study showed very minor socioeconomic differences in the injury risk among 0–4-year-old children in Sweden.<sup>20</sup> However, socioeconomic differences were observed for traffic injury risk from the age of 5 years onwards.<sup>20</sup> Another study reported that the relative risk of being injured in a road traffic incident is higher for 5–19-year-olds with low socioeconomic status than for those with higher socioeconomic status.<sup>21</sup> Alternatively, caregiver supervision might modify the association between unintentional injury and socioeconomic factors in younger ages, because the proportion of injuries witnessed by caregivers was high in our study. A previous study suggested lack of supervision made children under 5 years at risk of high mortality by unintentional injuries.<sup>22</sup> Therefore, the age of the children, which was under 6 years old in our study, might help to decrease the risk of unintentional injuries in lower socioeconomic status families. Second, the following characteristics specific to Japan might reduce the socioeconomic differences: relatively low exposure to environmental hazards, the social support network and ethnic homogeneity.<sup>23</sup> The absolute number of traffic accidents in Japan has gradually decreased from 887 000 in 2006 to 499 000 in 2016, owing to new road traffic laws and improvements in the quality of roads, vehicle engineering and driver behaviour.<sup>24 25</sup> The Japanese government provides households with children allowances according to income, employment or financial



**Table 6** Logistic regression models of socioeconomic indicators and unintentional injuries

Factors	OR (95% CI)	P values
Family type	0.60 (0.23 to 1.53)	0.283
Age of mother		0.433
<29 years	1 (reference)	
30–39 years	0.68 (0.37 to 1.22)	0.196
≥40 years	0.69 (0.34 to 1.37)	0.285
Age of father		0.849
<29 years	1 (reference)	
30–39 years	1.23 (0.58 to 2.61)	0.596
≥40 years	1.27 (0.56 to 2.85)	0.570
Education of mother		0.284
High school	1 (reference)	
Business technical school or junior college	1.20 (0.82 to 1.82)	0.334
College	0.90 (0.57 to 1.40)	0.629
Education of father		0.504
High school	1 (reference)	
Business technical school or junior college	0.78 (0.47 to 1.29)	0.339
College	0.81 (0.54 to 1.21)	0.299
Number of children		0.168
1	1 (reference)	
2	1.51 (0.98 to 2.31)	0.059
≥3	1.49 (0.79 to 2.79)	0.215
Infant (<1 year old)	0.78 (0.49 to 1.23)	0.278
Older siblings (>6 years old)	0.91 (0.58 to 1.43)	0.682
Living with grandmother	0.87 (0.52 to 1.47)	0.606
Living with grandfather	1.17 (0.83 to 1.65)	0.383
Mother's employment status	0.99 (0.67 to 1.47)	0.976
Father's employment status	0.79 (0.20 to 3.12)	0.737
Use of sitter, kindergarten or nursery school	1.38 (0.88 to 2.16)	0.165
Type of housing	0.97 (0.69 to 1.36)	0.836
Annual income (Yen)		0.849
<3 million	1 (reference)	
3–5 million	0.99 (0.58 to 1.69)	0.977
>5 million	0.90 (0.53 to 1.53)	0.701

support for single parent families, and visits for all families with infants.<sup>26</sup> All municipalities in Japan conduct health checkups at healthcare centres for children aged 18–23 months and children aged 36–47 months, despite socioeconomic differences. The mean response rate for these health checkups is over 90%.<sup>27</sup>

Taken together, our data and those from previous studies confirm that the relationship between unintentional injury and socioeconomic factors differs for each nation.<sup>6–8 10 11 13 28 29</sup> It is difficult to generalise the influence of socioeconomic factors on the risk of unintentional

childhood injuries. Therefore, prevention strategies should vary from country to country. In Japan, prevention strategies that focus on socioeconomic disadvantages would be inadequate. A comprehensive approach that involves health checkups could be a useful method for prevention of unintentional injuries.

### Limitations

This study had several limitations. First, only those households that had access to the internet were included. However, we selected households with a population distribution similar to that in the national census. We had a high internet penetration rate of the general population (83.5%) in Japan.<sup>30</sup> In addition, there were no differences between the relative poverty rates recorded in our study and those for the whole nation. Second, the outcome measures were based on self-reporting. The respondents may have been unaware of incidences of unintentional injury, or recalled the accident inaccurately. Thus, the incidence of unintentional injury might be underestimated. However, the incident rates recorded in our study are not very different from those obtained in other studies. Third, although we excluded households which had missing information regarding parent education and type of housing, this might have resulted in bias due to missing data. However, we excluded only 24 households. Additionally, the risk of unintentional injury was similar, despite of the high proportion of single parents in the missing data. Thus, it might not impact the validity of the conclusion. Finally, our inferences might be confounded by unmeasured factors, such as gender, mental health conditions and physical disability of the children. Future studies should measure the non-socioeconomic factors relating to unintentional injuries among children more explicitly.

### CONCLUSION

Unintentional injuries among preschool children occurred at approximately constant rates irrespective of the presence of socioeconomic factors. The association between socioeconomic factors and unintentional injury varies across different countries. Prevention strategies aimed at unintentional injuries that take socioeconomic disadvantages into consideration may not be applicable in Japan.

**Contributors** NS conceived the study. YH, JI and KA supervised the conduct of the trial and data collection. NS managed the data, including quality control. KA provided statistical advice on the study design and analysed the data; NS chaired the data oversight committee. NS, YH and KA drafted the manuscript, and all authors contributed substantially to its revision. NS takes responsibility for the paper as a whole. All authors read and approved the final manuscript.

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