

BMJ Open

BMJ Open is committed to open peer review. As part of this commitment we make the peer review history of every article we publish publicly available.

When an article is published we post the peer reviewers' comments and the authors' responses online. We also post the versions of the paper that were used during peer review. These are the versions that the peer review comments apply to.

The versions of the paper that follow are the versions that were submitted during the peer review process. They are not the versions of record or the final published versions. They should not be cited or distributed as the published version of this manuscript.

BMJ Open is an open access journal and the full, final, typeset and author-corrected version of record of the manuscript is available on our site with no access controls, subscription charges or pay-per-view fees (<http://bmjopen.bmj.com>).

If you have any questions on BMJ Open's open peer review process please email info.bmjopen@bmj.com

BMJ Open

Socioeconomic factors do not increase the risk for unintentional injuries among children in Japan: a cross-sectional study

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2018-021621
Article Type:	Research
Date Submitted by the Author:	11-Jan-2018
Complete List of Authors:	Sato, Nobuhiro; Niigata University Graduate School of Medicine, Department of Medical Informatics and Statistics Hagiwara, Yusuke; Tokyo Metropolitan Children's Medical Center, Department of Pediatric Emergency and Critical Care Medicine Ishikawa, Junta; Niigata University Graduate School of Medicine, Department of Medical Informatics and Statistics Akazawa, Kouhei; Niigata University Graduate School of Medicine, Department of Medical Informatics and Statistics
Keywords:	EPIDEMIOLOGY, PAEDIATRICS, Socioeconomic Status, Risk factor research

SCHOLARONE™
Manuscripts

Peer Review Only

1 Socioeconomic factors do not increase the risk for unintentional injuries among
2 children in Japan: a cross-sectional study

3

4 Nobuhiro Sato^{a)}, Yusuke Hagiwara^{b)}, Junta Ishikawa^{a)}, and Kohei Akazawa^{a)}

5

6 ^a Department of Medical Informatics and Statistics, Niigata University Graduate
7 School of Medicine, Niigata, Japan

8 ^b Department of Pediatric Emergency and Critical Care Medicine, Tokyo
9 Metropolitan Children's Medical Center, Fuchu, Tokyo, Japan

10

11 **Corresponding author:** Nobuhiro Sato, Department of Medical Informatics and
12 Statistics, Niigata University Graduate School of Medicine, 1-754 Asahimachi,
13 Chuo-ku, Niigata 951-8520, Japan. Tel.: +81-25-227-2471. Fax: +81-25-227-0850.
14 E-mail: s_nobuhiro@hosp.niigata.niigata.jp.

15

16 **Word count:** 1804

1
2
3
4
5 **17 ABSTRACT**

6
7 **18 Objectives:** To evaluate the influence of socioeconomic factors on the risk for
8
9 **19** unintentional injuries among preschool children in Japan

10
11 **20 Methods:** We used data from a web-based questionnaire survey that was sent to
12
13 **21** 1000 households with preschool children under 6 years of age. Multivariate
14
15 **22** logistic regression was performed to analyze the influence of socioeconomic
16
17 **23** factors on the incidence of unintentional injuries.

18
19 **24 Results:** Overall, 976 households were eligible for the analysis, with 201
20
21 **25** households reporting unintentional injuries. The incidence rates for unintentional
22
23 **26** injury were estimated to be constant across all strata constructed using
24
25 **27** combinations of socioeconomic factors. The multivariate logistic regression
26
27 **28** analysis showed no significant differences in socioeconomic factors between
28
29 **29** households that reported unintentional injuries and those that did not.

30
31 **30 Conclusion:** The findings of our study demonstrated that unintentional injuries
32
33 **31** among preschool children occurred at approximately fixed rates, independent of
34
35 **32** socioeconomic factors. Accordingly, prevention strategies for unintentional injuries
36
37 **33** that concern socioeconomic disadvantages should be avoided in Japan.

38
39 **34 Keywords:** Epidemiology, Pediatrics, Risk Factor Research, Socioeconomic
40
41 **35** Status

42
43
44
45 **37 'Strengths and limitations of this study'**

46
47 **38** This study evaluated the influence of socioeconomic factors on the risk for
48
49 **39** unintentional injuries among children in Japan via a nationwide questionnaire
50
51 **40** survey.

52
53 **41** We selected 1000 households with a population distribution similar to that in the
54
55 **42** national census.

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

43 Although multiple logistic regression analysis was used, our inferences might be
44 confounded by unmeasured factors, such as injury severity.

45

For peer review only

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
61
62
63
64
65
66
67
68
69
70
71
72
73
74
75
76
77
78
79
80**INTRODUCTION**

Unintentional injuries are a leading cause of death among children of all ages.[1-4] 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.[1] In particular, children aged 1 to 4 years demonstrate the highest all-cause and cause-specific mortality rates due to unintentional injuries.[1] The risks for unintentional injuries among children are mainly defined by individual factors (behaviors and attributes), the presence or absence of supervision, and safety equipment and vehicle safety (5). Moreover, the risks can be influenced by socioeconomic factors, including family income, parental education, single parenting, maternal age, older siblings, and type of housing.[6-13] 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.[10]

Similarly, in Japan, unintentional injuries have been a major cause of death among children aged ≥ 1 year since 1960.[14, 15] Furthermore, several socioeconomic issues exist in Japan. For example, income inequality ranks fourth highest across the Organization for Economic Cooperation and Development (OECD) member countries.[16] The relative poverty rate for households with children was 12.9% in 2015.[17] Moreover, the average age of married primigravidae is increasing, and currently stands at 30.7 years.[15] Thus far, only a few studies, however, have examined the relationship between socioeconomic status and unintentional injury among children in Japan.

1
2
3
4
5 72 The purpose of this study was to evaluate the influence of socioeconomic
6
7 73 factors on the risk for unintentional injuries among children in Japan via a
8
9 74 nationwide questionnaire survey.
10

11 75

12 76 **METHODS**

13 77 **Study design and participants**

14
15
16
17 78 This study involved a web-based questionnaire survey. The participants were
18
19 79 selected in January 2015 from a database of 1,370,000 candidates compiled by a
20
21 80 private Japanese company specializing in questionnaire-based research. We
22
23 81 extracted data for 1000 households with preschool children under 6 years of age.
24
25 82 All participants lived in Japan. Region was used as a variable for stratified random
26
27 83 sampling. Hence, the region-wise distribution of our sample was almost identical
28
29 84 to that of the general population in Japan. All respondents completed the
30
31 85 questionnaire on a website developed specially for this study by the survey
32
33 86 company. Exclusion criteria included not living with parents; missing information
34
35 87 regarding parent education and type of housing; and children being cared for by
36
37 88 people other than the parents, grandparents, kindergarten teacher, and nursery
38
39 89 teacher in the daytime. An urban area was defined as an area with >15 million
40
41 90 residents. Returning the questionnaire was taken as agreement to participate in
42
43 91 the study and informed consent was obtained from all participants. This study was
44
45 92 approved by the institutional ethics review board of Niigata City General Hospital.

46 93

47 94 **Measures**

48
49
50 95 The following socioeconomic factors were used for evaluation: father's
51
52 96 age; mother's age; living area; number of siblings; highest education levels of
53
54 97 parents; annual income of parents; type of housing; maternal employment; living
55
56
57
58
59
60

1
2
3
4
5 98 with grandparents; use of a sitter, kindergarten, or nursery school; and history of
6
7 99 injuries. Parents were divided into three groups according to the mean age of
8
9 100 mothers (30.7 years old) at the birth of the first child in Japan: ≤ 29 years, 30–39
10
11 101 years, ≥ 40 years.[15] Highest education level was classified as junior high school
12
13 102 or high school, business technical school or junior college, and college. Annual
14
15 103 income was classified as < 3 million yen, 3–5 million yen, ≥ 5 million yen, based on
16
17 104 the average income in Japan (median 4.28 million yen).[17] Type of housing was
18
19 105 divided into house and apartment house categories. Injury was defined as
20
21 106 physical damage that is fatal or causes aftereffects. We included the following
22
23 107 types of injuries: injuries caused by falls from stairs or a balcony; burns from hot
24
25 108 liquids, hot surfaces, or fire; accidental poisoning; foreign body aspiration or
26
27 109 suffocation; drowning; and traffic injuries.[10] The question on injury mechanism
28
29 110 allowed multiple answers.

30
31 111

32 112 **Statistical Analysis**

33
34
35 113 Continuous data with skewed distributions are shown as medians and
36
37 114 interquartile ranges, and categorical data as proportions. The Pearson's
38
39 115 chi-squared test was used to explore the significance of differences between
40
41 116 households reporting unintentional injuries and those that did not report any
42
43 117 injuries.

44
45 118 Multiple logistic regression analysis was used to estimate the odds ratios and
46
47 119 95% confidence intervals (CIs) after controlling simultaneously for potential
48
49 120 confounders. We included 14 significant risk factors in the analysis (Family type,
50
51 121 Age of parents, Education of parents, Number of children, Presence of infant or
52
53 122 older siblings, Living with grandparent, Mother's employment status, Use of sitter,
54
55 123 kindergarten, or nursery school, Type of housing, and Annual income). All

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

124 statistical tests were two-sided. A p-value less than 0.05 was considered
125 statistically significant. Data analysis was performed using SPSS, version 23.0
126 (IBM Corporation, Armonk, NY, USA).
127

For peer review only

128

129 **RESULTS**130 **Characteristics of the study population**

131 Of the 1000 households that participated in this study, 24 families were
 132 excluded because of missing data regarding the parents' education (n=2); type of
 133 housing (n=17); and caregivers apart from parents, grandparents, kindergarten
 134 teacher, and nursery school teacher (n=5). Table 1 shows the basic characteristics
 135 of the 976 households that were included in the study. The median age of the
 136 respondents was 38 years (interquartile range 33–42 years). In total, 201
 137 households reported unintentional injuries among children. Table 2 presents the
 138 distribution of the 201 unintentionally injured children according to
 139 injury-descriptive variables. The most frequently observed mechanism of injury
 140 was falls (67.2%), followed by burns (26.4%), poisoning/aspiration (9.5%),
 141 drowning (4.5%), traffic injury (3.5%), and others (6.5%).

142

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

Factors	N=976	%
Respondent		
Mother	569	58.3
Father	407	41.7
Region		
Urban area	678	69.5
Others	298	30.5
Family type		

Two parents	936	95.9
Single parent	40	4.1
Number of children		
1	375	38.4
2	447	45.8
≥3	154	15.8
Living with grandparent		
Yes	389	39.9
No	587	60.1
Use of sitter, kindergarten, or nursery school		
Yes	197	20.2
No	779	79.8
Type of housing		
House	516	52.9
Apartment	460	47.1
Annual income		
<3 million	117	12.0
3–5 million	366	37.5
>5 million	493	50.5
Unintentional injury		
Yes	201	20.6
No	775	79.4

143

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

Factors	n=201	%
Injury mechanism (multiple answers)		
Fall	135	67.2
Burn	53	26.4
Poisoning/Aspiration	19	9.5
Drowning	9	4.5
Traffic injury	7	3.5
Others	13	6.5
Time of injury		
Daytime on a weekday	106	52.7
Nighttime on a weekday	64	31.8
Holiday	31	15.4
Place of injury		
Home	188	93.5
Outdoor	13	6.5
Management after injury		
Visit hospital	112	55.7
Observation at home	88	43.8
Others	1	0.5

144

145 **Risk factors for unintentional injury among pre-school children in Japan**

146 Table 3 shows the incidence rates for 14 socioeconomic factors. The incidence
 147 of unintentional injury was estimated at approximately 21% with or without the
 148 presence of socioeconomic disadvantages. The risk for unintentional injuries
 149 was higher among preschool children with high-school graduate fathers and

150 those in families with more siblings. However, there were no significant
 151 differences in incident rates of unintentional injuries across all groups.

152 The results of the multivariate analysis are shown in Table 4. Between
 153 households reporting unintentional injuries and those that did not report any, no
 154 significant differences in terms of income of parents were observed in the incident
 155 rates of unintentional injuries among preschool children (adjusted odds ratio, 0.93;
 156 95% CI 0.72–1.18; p=0.531). Similarly, there were no significant differences in the
 157 other socioeconomic factors in terms of the incident rates of unintentional injuries
 158 among preschool children.

159

Table 3 Unadjusted models of comparing households with and without child
 unintentional injury

Factors	Overall (n=976)	Injury (n=201) %	p-value
Family type			p=0.372
Two parents	936	195 20.8	
Single parent	40	6 15.0	
Age of mother			p=0.635
<29 years	109	26 23.9	
30–39 years	579	115 19.9	
≥40 years	288	60 20.8	
Age of father			p=0.940
<29 years	68	14 20.6	
30–39 years	462	93 20.1	
≥40 years	446	94 21.1	

12

1				
2				
3				
4				
5	Education of mother			p=0.160
6				
7	High school	277	58	20.9
8				
9	Business technical school or junior college	351	82	23.4
10				
11	College	348	61	17.5
12				
13	Education of father			p=0.200
14				
15	High school	281	68	24.2
16				
17	Business technical school or junior college	150	30	20.0
18				
19	College	545	103	18.9
20				
21	Number of children			p=0.138
22				
23	1	375	65	17.3
24				
25	2	447	101	22.6
26				
27	≥3	154	35	22.7
28				
29				
30	Infant (<1 year old)			p=0.403
31				
32	Yes	170	31	18.2
33				
34	No	806	170	21.1
35				
36	Older siblings (>6 years old)			p=0.330
37				
38	Yes	374	83	22.2
39				
40	No	602	118	19.6
41				
42	Living with grandmother			p=0.933
43				
44	Yes	128	26	20.3
45				
46	No	848	175	20.6
47				
48	Living with grandfather			p=0.466
49				
50	Yes	362	79	21.8
51				
52	No	614	122	19.9
53				
54				
55				
56				
57				
58				
59				
60				

Mother's employment status				p=0.574
Employed	391	84	21.5	
Unemployed	585	117	20.0	
Use of sitter, kindergarten, or nursery school				p=0.143
Yes	197	48	24.4	
No	779	153	19.6	
Type of housing				p=0.554
House	516	110	21.3	
Apartment	460	91	19.8	
Annual income				p=0.855
<3 million	117	25	21.4	
3–5 million	366	78	21.3	
>5 million	493	98	19.9	

160

Table 4 Logistic regression models of socioeconomic indicators and unintentional injuries

Factors	Odds ratio	95% CI	p-value
Family type	0.61	(0.24–1.55)	0.299
Age of mother			0.437
<29 years	1	(reference)	
30–39 years	0.68	(0.37–1.23)	0.198
≥40 years	0.69	(0.34–1.38)	0.290
Age of father			0.858
<29 years	1	(reference)	

30–39 years	1.22	(0.57–2.59)	0.611
≥40 years	1.26	(0.56–2.83)	0.581
Education of mother			0.279
High school	1	(reference)	
Business technical school or junior college	1.22	(0.82–1.82)	0.324
College	0.90	(0.58–1.40)	0.638
Education of father			0.500
High school	1	(reference)	
Business technical school or junior college	0.78	(0.47–1.29)	0.337
College	0.81	(0.54–1.21)	0.295
Number of children			0.167
1	1	(reference)	
2	1.51	(0.99–2.31)	0.059
≥3	1.5	(0.80–2.81)	0.202
Infant (<1 year old)	0.78	(0.49–1.23)	0.280
Older siblings (>6 years old)	0.91	(0.58–1.43)	0.677
Living with grandmother	0.87	(0.52–1.47)	0.610
Living with grandfather	1.17	(0.83–1.65)	0.381
Mother's employment status	0.99	(0.67–1.47)	0.976
Use of sitter, kindergarten, or nursery school	1.38	(0.88–2.16)	0.163
Type of housing	0.97	(0.69–1.36)	0.838
Annual income			0.839
<3 million	1	(reference)	
3–5 million	0.99	(0.58–1.68)	0.963

>5 million 0.90 (0.53–1.52) 0.680

161

162 **DISCUSSION**

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

167 Our data showed that households whose annual income was under 3
168 million yen accounted for 12.0% of the population, whereas the relative poverty
169 rate for households with children was 12.9% in Japan.[17] The incidence rate of
170 unintentional injuries observed in our study is not very different from that reported
171 in other studies: 28.2 injuries per 100 children over a period of 1 year within a
172 population of 0–14-year-old children in a Greek town and 24.7 medically treated
173 injuries within a population of 0–19-year-old children and adolescents in a health
174 maintenance organization.[8, 18]

175 Nevertheless, our results differ from the outcomes reported in other
176 studies of the relationship between unintentional injuries and socioeconomic
177 factors.[7, 10, 12] There are several explanations for these results. First, these
178 results could be attributed to the injury mechanism. In a previous study, the effect
179 of the socioeconomic factors varied between injury mechanisms.[10] The risk for
180 burns (relative risk 1.9) and poisoning (relative risk 1.7) was higher in the
181 lowest-income group than in the highest-income group, while the risk for falls was
182 not significantly higher.[10] The most common injury mechanism was falls in our
183 study. Second, younger age of children, may affect the relationship between the
184 risk for unintentional injuries and socioeconomic factors. A previous study showed
185 very minor socioeconomic differences in the injury risk among 0–4-year-old

1
2
3
4
5 186 children in Sweden.[19] However, socioeconomic differences were observed for
6
7 187 traffic injury risk from the age of 5 years onwards.[19] Another study reported that
8
9 188 the relative risk of being injured in a road traffic incident is higher for
10
11 189 5–19-year-olds belonging to a low social class than for those belonging to other
12
13 190 social classes.[20] The age of the children, which was under 6 years old in our
14
15 191 study, may help to explain the disadvantage of lower socioeconomic classes.
16
17 192 Finally, the following characteristics specific to Japan might reduce the
18
19 193 socioeconomic differences: relatively low exposure to environmental hazards, the
20
21 194 social support network, and ethnic homogeneity.[21] The absolute number of
22
23 195 traffic accidents in Japan has gradually decreased from 887000 in 2006 to 499000
24
25 196 in 2016, owing to new road traffic laws and improvements in the quality of roads,
26
27 197 vehicle engineering, and driver behavior.[22, 23] The Japanese government
28
29 198 provides households with children's allowances according to income, employment
30
31 199 or financial support for single parent families, and visits for all families with
32
33 200 infants.[24] All municipalities in Japan conduct health checkups at healthcare
34
35 201 centers for children aged 18–23 months and children aged 36–47 months despite
36
37 202 socioeconomic differences. The mean response rate for these health checkups is
38
39 203 over 90%.[25]

40
41 204 Taken together, our data and those from previous studies, confirm that
42
43 205 the relationship between unintentional injury and socioeconomic factors differs for
44
45 206 each nation.[7, 8, 10, 11] It is difficult to generalize the influence of socioeconomic
46
47 207 factors on the risk for unintentional childhood injuries. Therefore, prevention
48
49 208 strategies should vary from country to country. In Japan, prevention strategies
50
51 209 that consider socioeconomic disadvantages would be inadequate. A
52
53 210 comprehensive approach that involves health checkups could be a useful method
54
55 211 for prevention of unintentional injuries.

212

213 Limitations

214 This study had several limitations. First, only those households that had
215 access to the internet were included. However, we selected households with a
216 population distribution similar to that in the national census. In addition, there were
217 no differences between the relative poverty rates recorded in our study and those
218 for the whole nation. Second, the outcome measures were based on self-reporting.
219 The respondents may have been unaware of incidences of unintentional injury,
220 and thus, the incidence of unintentional injury might be underestimated. However,
221 the incident rates recorded in our study are not very different from those obtained
222 in other studies. Finally, different injury severities might constitute a confounding
223 factor. Whether injuries tend to be more serious in lower socioeconomic groups
224 than in higher ones remains to be investigated. Future studies should measure the
225 severity of unintentional injuries among children more explicitly.

226

227 Conclusion

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

233

1
2
3
4
5 234 **CONTRIBUTORSHIP STATEMENT**

6
7 235 NS conceived the study. YH, JI and KA supervised the conduct of the trial
8
9 236 and data collection. NS managed the data, including quality control. KA provided
10
11 237 statistical advice on the study design and analyzed the data; NS chaired the data
12
13 238 oversight committee. NS, YH, and KA drafted the manuscript, and all authors
14
15 239 contributed substantially to its revision. NS takes responsibility for the paper as a
16
17 240 whole. All authors read and approved the final manuscript.

18
19 241

20
21 242 **COMPETING INTERESTS**

22
23 243 None declared.

24
25 244

26
27 245 **FUNDING**

28
29 246 We did not receive any specific funding for the study.

30
31 247

32
33 248 **DATA SHARING STATEMENT**

34
35 249 No additional data are available.

36
37 250
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

251

252 **References**

- 253 1. Alonge O, Khan UR, Hyder AA. Our Shrinking Globe: Implications for Child
254 Unintentional Injuries. *Pediatr Clin North Am* 2016;63:167–81.
- 255 2. Alonge O, Hyder AA. Reducing the global burden of childhood
256 unintentional injuries. *Arch Dis Child* 2014;99:62–9.
- 257 3. Hyder AA, Wali S, Fishman S, et al. The burden of unintentional injuries
258 among the under-five population in South Asia. *Acta Paediatr*
259 2008;97:267–75.
- 260 4. Krug EG, Sharma GK, Lozano R. The global burden of injuries. *Am J*
261 *Public Health* 2000;90:523–6.
- 262 5. Peden M, Oyegbite K, Ozanne-Smith J, et al. *World Report on Child Injury*
263 *Prevention*. Geneva: World Health Organization, 2008.
- 264 6. Nathens AB, Neff MJ, Goss CH, et al. Effect of an older sibling and birth
265 interval on the risk of childhood injury. *Inj Prev* 2000;6:219–22.
- 266 7. Hjern A, Ringback-Weitof G, Andersson R. Socio-demographic risk factors
267 for home-type injuries in Swedish infants and toddlers. *Acta Paediatr*
268 2001;90:61–8.
- 269 8. Petridou E, Anastasiou A, Katsiardanis K, et al. A prospective
270 population-based study of childhood injuries: the Velestino town study. *Eur*
271 *J Public Health* 2005;15:9–14.
- 272 9. Weitof GR, Hjern A, Haglund B, et al. Mortality, severe morbidity, and
273 injury in children living with single parents in Sweden: a population-based
274 study. *Lancet* 2003;361:289–95.
- 275 10. Laursen B, Nielsen JW. Influence of sociodemographic factors on the risk
276 of unintentional childhood home injuries. *Eur J Public Health*

- 1
2
3
4
5 277 2008;18:366–70.
6
7 278 11. Faelker T, Pickett W, Brison RJ. Socioeconomic differences in childhood
8
9 279 injury: a population-based epidemiologic study in Ontario, Canada. *Inj*
10
11 280 *Prev* 2000;6:203–8.
12
13 281 12. Laflamme L, Diderichsen F. Social differences in traffic injury risks in
14
15 282 childhood and youth--a literature review and a research agenda. *Inj Prev*
16
17 283 2000;6:293–8.
18
19 284 13. de Lourdes Drachler M, de Carvalho Leite JC, Marshall T, et al. Effects of
20
21 285 the home environment on unintentional domestic injuries and related
22
23 286 health care attendance in infants. *Acta Paediatr* 2007;96:1169–73.
24
25 287 14. Sekii H, Ohtsu T, Shirasawa T, et al. Childhood mortality due to
26
27 288 unintentional injuries in Japan, 2000–2009. *Int J Environ Res Public Health*
28
29 289 2013;10:528–40.
30
31 290 15. Director-General for statistics and information policy, Ministry of Health,
32
33 291 Labour and Welfare. Vital statistics in Japan. Trends up to 2015.
34
35 292 <http://www.mhlw.go.jp/english/database/db-hw/dl/81-1a2en.pdf> (accessed
36
37 293 20 Nov 2017).
38
39 294 16. OECD Rights and Translation Unit. Growing Unequal? Income Distribution
40
41 295 and Poverty in OECD Countries. Paris: OECD publications 2008.
42
43 296 17. Ministry of Health, Labour and Welfare. Comprehensive Survey of Living
44
45 297 Conditions of the People on Health and Welfare. Tokyo: Ministry of Health,
46
47 298 Labour and Welfare 2016.
48
49 299 18. Rivara FP, Calonge N, Thompson RS. Population-based study of
50
51 300 unintentional injury incidence and impact during childhood. *Am J Public*
52
53 301 *Health* 1989;79:990–4.
54
55 302 19. Engstrom K, Diderichsen F, Laflamme L. Socioeconomic differences in

- 1
2
3
4
5 303 injury risks in childhood and adolescence: a nation-wide study of
6
7 304 intentional and unintentional injuries in Sweden. *Inj Prev* 2002;8:137–42.
8
9 305 20. Laflamme L, Engstrom K. Socioeconomic differences in Swedish children
10
11 306 and adolescents injured in road traffic incidents: cross sectional study.
12
13 307 *BMJ* 2002;324:396–7.
14
15 308 21. Kagamimori S, Gaina A, Nasermoaddeli A. Socioeconomic status and
16
17 309 health in the Japanese population. *Soc Sci Med* 2009;68:2152–60.
18
19 310 22. Nagata T, Setoguchi S, Hemenway D, et al. Effectiveness of a law to
20
21 311 reduce alcohol-impaired driving in Japan. *Inj Prev* 2008;14:19–23.
22
23 312 23. National Police Agency. Trends in traffic accidents by year. Tokyo: Traffic
24
25 313 accidents situation 2016.
26
27 314 24. Ministry of Health, Labour and Welfare. Equal Employment and Child
28
29 315 Welfare. Tokyo: Ministry of Health, Labour and Welfare 2015.
30
31 316 25. Yamamoto N, Honda C, Nagata S. Current trends and age-based
32
33 317 differences of unintentional injury in Japanese children. *Biosci Trends*
34
35 318 2016;10:152–7.
36
37 319

STROBE Statement—checklist of items that should be included in reports of observational studies

	Item No	Recommendation	Reported on page #
Title and abstract	1	(a) Indicate the study's design with a commonly used term in the title or the abstract	p2
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	p2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	P4
Objectives	3	State specific objectives, including any prespecified hypotheses	P4
Methods			
Study design	4	Present key elements of study design early in the paper	P5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	P5
Participants	6	(a) <i>Cohort study</i> —Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up	P5
		<i>Case-control study</i> —Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls	
		<i>Cross-sectional study</i> —Give the eligibility criteria, and the sources and methods of selection of participants	
		(b) <i>Cohort study</i> —For matched studies, give matching criteria and number of exposed and unexposed <i>Case-control study</i> —For matched studies, give matching criteria and the number of controls per case	
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	P5, 6
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	P5,6
Bias	9	Describe any efforts to address potential sources of bias	P5,6
Study size	10	Explain how the study size was arrived at	P5
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	P6
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	P6
		(b) Describe any methods used to examine subgroups and interactions	P6
		(c) Explain how missing data were addressed	P5
		(d) <i>Cohort study</i> —If applicable, explain how loss to follow-up was addressed <i>Case-control study</i> —If applicable, explain how matching of cases and controls was addressed	P5

Cross-sectional study—If applicable, describe analytical methods taking account of sampling strategy

(e) Describe any sensitivity analyses

Results

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	P7
		(b) Give reasons for non-participation at each stage	P7
		(c) Consider use of a flow diagram	
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	P7,8,9
		(b) Indicate number of participants with missing data for each variable of interest	P7
		(c) <i>Cohort study</i> —Summarise follow-up time (eg, average and total amount)	
Outcome data	15*	<i>Cohort study</i> —Report numbers of outcome events or summary measures over time	
		<i>Case-control study</i> —Report numbers in each exposure category, or summary measures of exposure	
		<i>Cross-sectional study</i> —Report numbers of outcome events or summary measures	P7,8,9
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	P9,10,11,12,13
		(b) Report category boundaries when continuous variables were categorized	P9,10,11,12
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	

Discussion

Key results	18	Summarise key results with reference to study objectives	P14
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	P15,16
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	P14,15
Generalisability	21	Discuss the generalisability (external validity) of the study results	P14,15

Other information

Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	P17
---------	----	---	-----

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

1
2 **Note:** An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE
3 checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at
4 <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at www.strobe-statement.org.
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46

For peer review only

BMJ Open

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

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2018-021621.R1
Article Type:	Research
Date Submitted by the Author:	09-May-2018
Complete List of Authors:	Sato, Nobuhiro; Niigata University Graduate School of Medicine, Department of Medical Informatics and Statistics Hagiwara, Yusuke; Tokyo Metropolitan Children's Medical Center, Department of Pediatric Emergency and Critical Care Medicine Ishikawa, Junta; Niigata University Graduate School of Medicine, Department of Medical Informatics and Statistics Akazawa, Kouhei; Niigata University Graduate School of Medicine, Department of Medical Informatics and Statistics
Primary Subject Heading:	Epidemiology
Secondary Subject Heading:	Paediatrics, Epidemiology
Keywords:	EPIDEMIOLOGY, PAEDIATRICS, Socioeconomic Status, Risk factor research

SCHOLARONE™
Manuscripts

Only

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

3

4 Nobuhiro Sato^{a)}, Yusuke Hagiwara^{b)}, Junta Ishikawa^{a)}, and Kohei Akazawa^{a)}

5

6 ^a Department of Medical Informatics and Statistics, Niigata University Graduate
7 School of Medicine, Niigata, Japan

8 ^b Department of Pediatric Emergency and Critical Care Medicine, Tokyo
9 Metropolitan Children's Medical Center, Fuchu, Tokyo, Japan

10

11 **Corresponding author:** Nobuhiro Sato, Department of Medical Informatics and
12 Statistics, Niigata University Graduate School of Medicine, 1-754 Asahimachi,
13 Chuo-ku, Niigata 951-8520, Japan. Tel.: +81-25-227-2471. Fax: +81-25-227-0850.
14 E-mail: s_nobuhiro@hosp.niigata.niigata.jp.

15

16 **Word count:** 2346

1
2
3
4
5 17 **ABSTRACT**
6

7 18 **Objectives:** While Japan has socioeconomic issues, such as income inequality,
8
9 19 little is known about the association between socioeconomic factors and the risk
10
11 20 of unintentional childhood injuries. The purpose of the study was to evaluate the
12
13 21 influence of socioeconomic factors on the risk for unintentional injuries among
14
15 22 preschool children in Japan.

16
17 23 **Methods:** We used data from a web-based questionnaire survey that was sent to
18
19 24 1000 households with preschool children under 6 years of age. Multivariate
20
21 25 logistic regression was performed to analyze the influence of socioeconomic
22
23 26 factors on the incidence of unintentional injuries.

24
25 27 **Results:** Overall, 976 households were eligible for the analysis, with 201
26
27 28 households reporting unintentional injuries. The incidence rates for unintentional
28
29 29 injury were estimated to be constant across all strata constructed using
30
31 30 combinations of socioeconomic factors. The multivariate logistic regression
32
33 31 analysis showed no significant differences in socioeconomic factors between
34
35 32 households that reported unintentional injuries and those that did not.

36
37 33 **Conclusion:** The findings of our study demonstrated that unintentional injuries
38
39 34 among preschool children occurred at approximately fixed rates, independent of
40
41 35 socioeconomic factors. Accordingly, prevention strategies for unintentional injuries
42
43 36 that focus on socioeconomic disadvantages should be avoided in Japan.

44
45 37 **Keywords:** Epidemiology, Pediatrics, Risk Factor Research, Socioeconomic
46
47 38 Status
48

49
50
51 40 **'Strengths and limitations of this study'**
52
53
54
55
56
57
58
59
60

1
2
3
4
5 41 This study evaluated the influence of socioeconomic factors on the risk of
6
7 42 unintentional injuries among children in Japan via a nationwide questionnaire
8
9 43 survey.

10
11 44 We selected 1000 households with a population distribution similar to that in the
12
13 45 national census.

14
15 46 Although multiple logistic regression analysis was used, our inferences might be
16
17 47 confounded by unmeasured factors, such as physical disability of the children.
18

19 48

49 INTRODUCTION

50 Unintentional injuries are a leading cause of death among children of all ages.¹⁻⁴

51 The term “unintentional injury” in this context is defined as an injury that is not
52 inflicted deliberately; the injury may have been caused by a fall, poisoning,
53 drowning, burns, or traffic-related accidents. Globally, unintentional injuries
54 accounted for 15.4% of approximately 2.6 million deaths recorded for children
55 aged 1 to 14 years in 2013.¹ In particular, children aged 1 to 4 years demonstrate
56 the highest all-cause and cause-specific mortality rates due to unintentional
57 injuries.¹ The risks for unintentional injuries among children are mainly defined by
58 individual factors (behaviors and attributes), the presence or absence of
59 supervision, and safety equipment and vehicle safety.⁵ Moreover, the risks can be
60 influenced by socioeconomic factors, including family income, parental education,
61 single parenting, maternal age, older siblings, and type of housing.⁶⁻¹³ In fact,
62 Laursen et.al. reported that children with young mothers and mothers with only
63 primary school education were at higher risk for most types of injuries than other
64 children in Denmark.¹⁰

65 Similarly, in Japan, unintentional injuries have been a major cause of death
66 among children aged ≥ 1 year since 1960.^{14 15} Furthermore, several
67 socioeconomic issues exist in Japan. For example, Japan is ranked fourth highest
68 for income inequality across the Organization for Economic Cooperation and
69 Development (OECD) member countries.¹⁶ The relative poverty rate for
70 households with children was 12.9% in 2015.¹⁷ A previous study revealed the
71 association between socioeconomic inequality and the risk for infant abuse in
72 Japan.¹⁸ However, only a few studies have examined the relationship between
73 socioeconomic status and unintentional injury among children in Japan thus far.

74 The purpose of this study was to evaluate the influence of socioeconomic

1
2
3
4
5 75 factors on the risk for unintentional injuries among children in Japan via a
6
7 76 nationwide questionnaire survey.
8
9 77

10 78 **METHODS**

11 79 **Study design and participants**

12
13
14
15 80 This study involved a web-based questionnaire survey. The participants were
16
17 81 selected in January 2015 from a database of 1,370,000 candidates compiled by a
18
19 82 private Japanese company specializing in questionnaire-based research. We
20
21 83 extracted data for 1000 households with preschool children under 6 years of age.
22
23 84 All participants lived in Japan. Region was used as a variable for stratified random
24
25 85 sampling. Hence, the region-wise distribution of our sample was almost identical
26
27 86 to that of the general population in Japan. All respondents completed the
28
29 87 questionnaire on a website developed specially for this study by the survey
30
31 88 company. Exclusion criteria included not living with parents; missing information
32
33 89 regarding parent education and type of housing; and children being cared for by
34
35 90 people other than the parents, grandparents, kindergarten teachers, and nursery
36
37 91 teachers during the daytime. An urban area was defined as an area with >15
38
39 92 million residents. Returning the questionnaire was taken as agreement to
40
41 93 participate in the study and informed consent was obtained from all participants.
42
43 94 This study was approved by the institutional ethics review board of Niigata City
44
45 95 General Hospital.
46
47 96

48 97 **Measures**

49
50 98 The questionnaire included 20 questions about basic and socioeconomic
51
52 99 characteristics and 17 questions concerning unintentional injuries. The following
53
54 100 socioeconomic factors were used for evaluation: father's age; mother's age; living
55
56
57
58
59
60

1
2
3
4
5 101 area; number of siblings; highest education level of parents; annual income of
6
7 102 parents; type of housing; parents' employment status; living with grandparents;
8
9 103 primary caregiver during the daytime and at night; use of a sitter, kindergarten, or
10
11 104 nursery school; and history of injuries. Parents were divided into three groups
12
13 105 according to the mean age of mothers (30.7 years old) at the birth of the first child
14
15 106 in Japan: ≤ 29 years, 30–39 years, ≥ 40 years.¹⁵ Highest education level was
16
17 107 classified as junior high school or high school, business technical school or junior
18
19 108 college, and college. Annual income was classified as < 3 million yen, 3–5 million
20
21 109 yen, and ≥ 5 million yen, based on the average income in Japan (median 4.28
22
23 110 million yen).¹⁷ Type of housing was divided into house and apartment categories.
24
25 111 Injury was defined as physical damage that is fatal or causes aftereffects. We
26
27 112 included the following types of injuries: all injuries, such as falls from stairs or a
28
29 113 balcony; burns from hot liquids, hot surfaces, or fire; accidental poisoning; foreign
30
31 114 body aspiration or suffocation; drowning; and traffic injuries.¹⁰ The information
32
33 115 collected about unintentional injuries included gender of child, time, place of injury,
34
35 116 witnessed by others or not, and management after injury. The injury mechanism
36
37 117 was defined as the injury that the respondent considered to be the most severe.
38
39 118

119 **Statistical Analysis**

120 The sample size calculation was performed on the basis of a statistical power of
121 80%, two-sided P-value of 0.05, an event rate of 25%, and a relative risk of
122 socioeconomic disadvantage of 1.2, obtained from previous studies.^{8 10 19}

123 Continuous data with skewed distributions are shown as medians and
124 interquartile ranges, and categorical data as proportions. The Pearson's
125 chi-squared test or Fisher's exact test was used to explore the significance of
126 differences between households reporting unintentional injuries and those that did

1
2
3
4
5 127 not report any injuries.

6
7 128 Multiple logistic regression analysis was used to estimate the odds ratios and
8
9 129 95% confidence intervals (CIs) after controlling simultaneously for potential
10
11 130 confounders. We used unintentional injury as the dependent variable. We
12
13 131 included 15 significant risk factors in the analysis (family type, age of parents,
14
15 132 education of parents, number of children, presence of infant or older siblings,
16
17 133 living with grandparent, parents' employment status, use of sitter, kindergarten, or
18
19 134 nursery school, type of housing, and annual income). All statistical tests were
20
21 135 two-sided. A p-value less than 0.05 was considered statistically significant. Data
22
23 136 analysis was performed using SPSS, version 23.0 (IBM Corporation, Armonk, NY,
24
25 137 USA).

26
27 138

28 29 139 **Patient and Public Involvement**

30
31 140 The participants in this web-based questionnaire survey were selected
32
33 141 from a database of candidates compiled by a private Japanese company
34
35 142 specializing in questionnaire-based research. Returning the questionnaire was
36
37 143 taken as agreement to participate in the study and informed consent was obtained
38
39 144 from all participants.

40
41 145

42 43 146 **RESULTS**

44 45 147 **Characteristics of the study population**

46
47 148 Of the 1000 households that participated in this study, 24 families were
48
49 149 excluded because of missing data regarding the parents' education (n=2); type of
50
51 150 housing (n=17); and primary caregivers apart from parents, grandparents,
52
53 151 kindergarten teachers, and nursery school teachers during the daytime (n=5).

54
55 152 Table 1 shows the basic characteristics of the 976 households that were included

153 in the study. The median age of the respondents was 38 years (interquartile range
 154 33–42 years). In total, 201 households reported unintentional injuries among
 155 children. Table 2 presents the distribution of the 201 unintentionally injured
 156 children according to injury-descriptive variables. The most frequently observed
 157 mechanism of injury was falls (58.2%), followed by burns (23.4%),
 158 poisoning/aspiration (6.0%), drowning (3.0%), traffic injury (3.5%), and others
 159 (6.0%).

160

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

Factors	N=976	%
Respondent		
Mother	569	58.3
Father	407	41.7
Region		
Urban area	678	69.5
Others	298	30.5
Family type		
Two parents	936	95.9
Single parent	40	4.1
Number of children		
1	375	38.4
2	447	45.8
≥3	154	15.8
Living with grandparent		

Yes	389	39.9
No	587	60.1
Use of sitter, kindergarten, or nursery school		
Yes	197	20.2
No	779	79.8
Type of housing		
House	516	52.9
Apartment	460	47.1
Annual income (Yen)		
<3 million	117	12.0
3–5 million	366	37.5
>5 million	493	50.5
Unintentional injury		
Yes	201	20.6
No	775	79.4

161

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

Factors	n=201	%
Injury mechanism		
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
Gender of child		
Male	119	59.2
Female	82	40.8
Time of injury		
Daytime on a weekday	106	52.7
Nighttime on a weekday	64	31.8
Holiday	31	15.4
Place of injury		
Home	188	93.5
Outdoor	13	6.5
Witnessed by caregivers		
Yes	129	64.2
No	72	35.8
Management after injury		
Visit hospital	112	55.7
Observation at home	88	43.8
Others	1	0.5

162

163 **Risk factors for unintentional injury among preschool children in Japan**

164 Table 3 shows the incidence rates of 15 socioeconomic factors. The incidence
 165 of unintentional injury was estimated at approximately 21% with or without the
 166 presence of socioeconomic disadvantages. The risk for unintentional injuries
 167 was higher among preschool children with high-school graduate fathers and
 168 those in families with more siblings. However, there were no significant

1
2
3
4
5 169 differences in incident rates of unintentional injuries across all groups. Table 4
6
7 170 shows the association between socioeconomic factors and timing of injury. Table
8
9 171 5 shows the association between socioeconomic factors and management after
10
11 172 injury. Consistent with the main results, there was no relationship between
12
13 173 socioeconomic factors and the variables in these tables.

14
15 174 The results of the multivariate analysis are shown in Table 6. Between
16
17 175 households reporting unintentional injuries and those that did not report any, no
18
19 176 significant differences in terms of income of parents were observed in the incident
20
21 177 rates of unintentional injuries among preschool children (adjusted odds ratio, 0.90;
22
23 178 95% CI 0.53–1.53; $p=0.701$). Similarly, there were no significant differences in the
24
25 179 other socioeconomic factors in terms of the incident rates of unintentional injuries
26
27 180 among preschool children.

181

Table 3. Unadjusted risk for Unintentional injuries among children and socioeconomic factors

Factors	Overall (n=976)	Unintentional injury							p-value [†]	
		Fall	Burn	Poisoning/ Aspiration	Drowning	Traffic injury	Others	Total		
		(n=117)	(n=47)	(n=12)	(n=6)	(n=7)	(n=12)	(n=201)		%*
Family type										p=0.372
Two parents	936	112	47	12	6	6	12	195	20.8	
Single parent	40	5	0	0	0	1	0	6	15.0	
Age of mother										p=0.635
<29 years	109	15	5	0	4	0	2	26	23.9	
30–39 years	579	64	28	8	2	5	8	115	19.9	
≥40 years	288	38	14	4	0	2	2	60	20.8	
Age of father										p=0.940
<29 years	68	9	3	0	1	0	1	14	20.6	
30–39 years	462	55	22	6	3	2	5	93	20.1	
≥40 years	446	53	22	6	2	5	6	94	21.1	
Education of mother										p=0.160
High school	277	33	15	2	2	2	4	58	20.9	

1											
2											
3											
4											
5											
6											
7											
8											
9	Business technical										
10	school or junior	351	48	22	3	1	4	4	82	23.4	
11	college										
12											
13											
14	College	348	36	10	7	3	1	4	61	17.5	
15	Education of father										p=0.200
16	High school	281	39	20	3	1	3	2	68	24.2	
17											
18											
19	Business technical										
20	school or junior	150	20	6	2	0	0	2	30	20.0	
21	college										
22											
23											
24	College	545	58	21	7	5	4	8	103	18.9	
25	Number of children										p=0.138
26	1	375	44	11	3	2	1	4	65	17.3	
27	2	447	53	26	7	4	4	7	101	22.6	
28	≥3	154	20	10	2	0	2	1	35	22.7	
29											
30											
31	Infant (<1 year old)										p=0.403
32	Yes	170	19	6	3	2	0	1	31	18.2	
33	No	806	98	41	9	4	7	11	170	21.1	
34											
35	Older siblings (>6 years old)										p=0.330
36	Yes	374	47	22	5	1	4	4	83	22.2	
37	No	602	70	25	7	5	3	8	118	19.6	
38											
39											
40											
41											
42											
43											
44											
45											
46											
47											

14

8	Living with grandmother										p=0.933
9	Yes	128	14	7	0	1	1	3	26	20.3	
10	No	848	103	40	12	5	6	9	175	20.6	
11	Living with grandfather										p=0.466
12	Yes	362	47	19	4	2	1	6	79	21.8	
13	No	614	70	28	8	4	6	6	122	19.9	
14	Mother's employment status										p=0.574
15	Employed	391	52	19	3	1	4	5	84	21.5	
16	Unemployed	585	65	28	9	5	3	7	117	20.0	
17	Father's employment status										p=0.463
18	Employed	964	114	47	12	6	7	12	198	20.5	
19	Unemployed	12	3	0	0	0	0	0	3	25.0	
20	Use of sitter, kindergarten, or nursery school										p=0.143
21	Yes	197	32	9	2	0	2	3	48	24.4	
22	No	779	85	38	10	6	5	9	153	19.6	
23	Type of housing										p=0.554
24	House	516	66	28	2	2	4	8	110	21.3	
25	Apartment	460	51	19	10	4	3	4	91	19.8	
26	Annual income (Yen)										p=0.855
27	<3 million	117	15	5	2	0	1	2	25	21.4	
28	3–5 million	366	48	17	2	4	2	5	78	21.3	

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47

>5 million	493	54	25	8	2	4	5	98	19.9
------------	-----	----	----	---	---	---	---	----	------

182 ※ The proportion of the total number of unintentional injuries to the overall number of each socioeconomic factor

183 † The Pearson's chi-squared test or Fisher's exact test for total number of unintentional injuries

For peer review only

Table 4. Timing of unintentional injuries among children and socioeconomic factors

Factors	Overall (n=976)	Unintentional injury			
		Daytime on a weekday (n=106)	Nighttime on a weekday (n=64)	Holiday (n=31)	Total (n=201)
Family type					
Two parents	936	102	62	31	195
Single parent	40	4	2	0	6
Age of mother					
<29 years	109	14	8	4	26
30–39 years	579	65	32	18	115
≥40 years	288	27	24	9	60
Age of father					
<29 years	68	9	4	1	14
30–39 years	462	52	26	15	93
≥40 years	446	45	34	15	94
Education of mother					
High school	277	29	20	9	58
Business technical school or junior college	351	43	25	14	82
College	348	34	19	8	61
Education of father					
High school	281	34	22	12	68
Business technical school or junior college	150	19	8	3	30
College	545	53	34	16	103
Number of children					
1	375	37	19	9	65
2	447	50	34	17	101
≥3	154	19	11	5	35
Infant (<1 year old)					
Yes	170	23	7	1	31
No	806	83	57	30	170

Older siblings (>6 years old)					
Yes	374	43	24	16	83
No	602	63	40	15	118
Living with grandmother					
Yes	128	13	7	6	26
No	848	93	57	25	175
Living with grandfather					
Yes	362	44	26	9	79
No	614	62	38	22	122
Mother's employment status					
Employed	391	35	33	16	84
Unemployed	585	71	31	15	117
Father's employment status					
Employed	964	104	63	31	198
Unemployed	12	2	1	0	3
Use of sitter, kindergarten, or nursery school					
Yes	197	16	21	11	48
No	779	90	43	20	153
Type of housing					
House	516	59	34	17	110
Apartment	460	47	30	14	91
Annual income (Yen)					
<3 million	117	15	9	1	25
3–5 million	366	42	23	13	78
>5 million	493	49	32	17	98

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)	
Family type					
Two parents	936	109	85	1	195

1						
2						
3						
4						
5	Single parent	40	3	3	0	6
6	Age of mother					
7	<29 years	109	8	18	0	26
8	30–39 years	579	63	52	0	115
9	≥40 years	288	41	18	1	60
10	Age of father					
11	<29 years	68	5	9	0	14
12	30–39 years	462	51	42	0	93
13	≥40 years	446	56	37	1	94
14	Education of mother					
15	High school	277	27	30	0	58
16	Business technical					
17	school or junior college	351	53	29	0	82
18	College	348	32	29	1	61
19	Education of father					
20	High school	281	39	28	1	68
21	Business technical					
22	school or junior college	150	19	11	0	30
23	College	545	54	49	0	103
24	Number of children					
25	1	375	26	38	1	65
26	2	447	61	40	0	101
27	≥3	154	25	10	0	35
28	Infant (<1 year old)					
29	Yes	170	13	18	0	31
30	No	806	99	70	1	170
31	Older siblings (>6 years old)					
32	Yes	374	55	28	0	83
33	No	602	57	60	1	118
34	Living with grandmother					
35	Yes	128	13	13	0	26
36	No	848	99	75	1	175
37						
38						
39						
40						
41						
42						
43						
44						
45						
46						
47						
48						
49						
50						
51						
52						
53						
54						
55						
56						
57						
58						
59						
60						

1					
2					
3					
4					
5	Living with grandfather				
6	Yes	362	44	35	0 79
7	No	614	68	53	1 122
8					
9	Mother's employment status				
10	Employed	391	53	31	0 84
11	Unemployed	585	59	57	1 117
12					
13	Father's employment status				
14	Employed	964	110	87	1 198
15	Unemployed	12	2	1	0 3
16					
17	Use of sitter, kindergarten, or nursery				
18	school				
19	Yes	197	32	16	0 48
20	No	779	80	72	1 153
21					
22	Type of housing				
23	House	516	73	37	0 110
24	Apartment	460	39	51	1 91
25					
26	Annual income (Yen)				
27	<3 million	117	14	11	0 25
28	3–5 million	366	36	41	1 78
29	>5 million	493	62	36	0 98
30					
31					
32					

184

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

Factors	Odds ratio	95% CI	p-value
Family type	0.60	(0.23–1.53)	0.283
Age of mother			0.433
<29 years	1	(reference)	
30–39 years	0.68	(0.37–1.22)	0.196
≥40 years	0.69	(0.34–1.37)	0.285
Age of father			0.849
<29 years	1	(reference)	

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

3–5 million	0.99	(0.58–1.69)	0.977
>5 million	0.90	(0.53–1.53)	0.701

185

186 **DISCUSSION**

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

191 Our data showed that households whose annual income was under 3
 192 million yen accounted for 12.0% of the population, whereas the relative poverty
 193 rate for households with children was 12.9% in Japan.¹⁷ The incidence rate of
 194 unintentional injuries observed in our study is not very different from that reported
 195 in other studies: 29.0 injuries per 100 children over a period of 1 year within a
 196 population of 0–4-year-old children in a Greek town and 17.4 medically treated
 197 injuries within a population of 0–4-year-old children and adolescents in a health
 198 maintenance organization.^{8 19}

199 Nevertheless, our results differ from the outcomes reported in other
 200 studies of the relationship between unintentional injuries and socioeconomic
 201 factors.^{7 10 12} There are several explanations for these results. First, the younger
 202 age of children may affect the relationship between the risk for unintentional
 203 injuries and socioeconomic factors. A previous study showed very minor
 204 socioeconomic differences in the injury risk among 0–4-year-old children in
 205 Sweden.²⁰ However, socioeconomic differences were observed for traffic injury
 206 risk from the age of 5 years onwards.²⁰ Another study reported that the relative
 207 risk of being injured in a road traffic incident is higher for 5–19-year-olds belonging

1
2
3
4
5 208 to a low social class than for those belonging to other social classes.²¹
6
7 209 Alternatively, caregiver supervision might modify the association between
8
9 210 unintentional injury and socioeconomic factors in younger ages, because the
10
11 211 proportion of injuries witnessed by caregivers was high in our study. A previous
12
13 212 study suggested lack of supervision made children under 5 years at risk of high
14
15 213 mortality by unintentional injuries.²² Therefore, the age of the children, which was
16
17 214 under 6 years old in our study, might help to decrease the risk of unintentional
18
19 215 injuries in lower socioeconomic classes. Second, the following characteristics
20
21 216 specific to Japan might reduce the socioeconomic differences: relatively low
22
23 217 exposure to environmental hazards, the social support network, and ethnic
24
25 218 homogeneity.²³ The absolute number of traffic accidents in Japan has gradually
26
27 219 decreased from 887000 in 2006 to 499000 in 2016, owing to new road traffic laws
28
29 220 and improvements in the quality of roads, vehicle engineering, and driver
30
31 221 behavior.^{24 25} The Japanese government provides households with children's
32
33 222 allowances according to income, employment, or financial support for single
34
35 223 parent families, and visits for all families with infants.²⁶ All municipalities in Japan
36
37 224 conduct health checkups at healthcare centers for children aged 18–23 months
38
39 225 and children aged 36–47 months, despite socioeconomic differences. The mean
40
41 226 response rate for these health checkups is over 90%.²⁷

42
43 227 Taken together, our data and those from previous studies, confirm that
44
45 228 the relationship between unintentional injury and socioeconomic factors differs for
46
47 229 each nation.^{7 8 10 11} It is difficult to generalize the influence of socioeconomic
48
49 230 factors on the risk of unintentional childhood injuries. Therefore, prevention
50
51 231 strategies should vary from country to country. In Japan, prevention strategies
52
53 232 that focus on socioeconomic disadvantages would be inadequate. A
54
55 233 comprehensive approach that involves health checkups could be a useful method

1
2
3
4
5 234 for prevention of unintentional injuries.

6
7 235

8
9 236 **Limitations**

10
11 237 This study had several limitations. First, only those households that had

12
13
14 238 access to the internet were included. However, we selected households with a

15
16
17 239 population distribution similar to that in the national census. We had a high

18
19
20 240 internet penetration rate of the general population (83.5%) in Japan.²⁸ In addition,

21
22
23 241 there were no differences between the relative poverty rates recorded in our study

24
25
26 242 and those for the whole nation. Second, the outcome measures were based on

27
28
29 243 self-reporting. The respondents may have been unaware of incidences of

30
31
32 244 unintentional injury, or recalled the accident inaccurately. Thus, the incidence of

33
34
35 245 unintentional injury might be underestimated. However, the incident rates

36
37
38 246 recorded in our study are not very different from those obtained in other studies.

39
40
41 247 Third, although we excluded households which had missing information regarding

42
43
44 248 parent education and type of housing, this might have resulted in bias due to

45
46
47 249 missing data. However, we excluded only 24 households. Additionally, the risk of

48
49
50 250 unintentional injury was similar, despite of the high proportion of single parents in

51
52
53 251 the missing data. Thus, it might not impact the validity of the conclusion. Finally,

54
55
56 252 our inferences might be confounded by unmeasured factors, such as gender,

1
2
3
4
5
6 253 mental health conditions, and physical disability of the children. Future studies
7
8
9 254 should measure the non-socioeconomic factors relating to unintentional injuries
10
11
12 255 among children more explicitly.

13 256

14
15 257 **Conclusion**

16
17 258 Unintentional injuries among preschool children occurred at approximately
18
19 259 constant rates irrespective of the presence of socioeconomic factors. The
20
21 260 association between socioeconomic factors and unintentional injury varies across
22
23 261 different countries. Prevention strategies aimed at unintentional injuries that take
24
25 262 socioeconomic disadvantages into consideration may not be applicable in Japan.
26

27 263
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

1
2
3
4
5 264 **CONTRIBUTORSHIP STATEMENT**

6
7 265 NS conceived the study. YH, JI, and KA supervised the conduct of the
8
9 266 trial and data collection. NS managed the data, including quality control. KA
10
11 267 provided statistical advice on the study design and analyzed the data; NS chaired
12
13 268 the data oversight committee. NS, YH, and KA drafted the manuscript, and all
14
15 269 authors contributed substantially to its revision. NS takes responsibility for the
16
17 270 paper as a whole. All authors read and approved the final manuscript.

18
19 271

20
21 272 **COMPETING INTERESTS**

22
23 273 None declared.

24
25 274

26
27 275 **FUNDING**

28
29 276 This research received no specific grant from any funding agency in the
30
31 277 public, commercial or not-for-profit sectors.

32
33 278

34
35 279 **DATA SHARING STATEMENT**

36
37 280 The database set was available for all authors of the study, and will be available
38
39 281 for other non-commercial researchers on request.

282 **References**

- 283 1. Alonge O, Khan UR, Hyder AA. Our Shrinking Globe: Implications for Child
284 Unintentional Injuries. *Pediatr Clin North Am* 2016;63:167–81.
- 285 2. Alonge O, Hyder AA. Reducing the global burden of childhood
286 unintentional injuries. *Arch Dis Child* 2014;99:62–9.
- 287 3. Hyder AA, Wali S, Fishman S, et al. The burden of unintentional injuries
288 among the under-five population in South Asia. *Acta Paediatr*
289 2008;97:267–75.
- 290 4. Krug EG, Sharma GK, Lozano R. The global burden of injuries. *Am J*
291 *Public Health* 2000;90:523–6.
- 292 5. Peden M, Oyegbite K, Ozanne-Smith J, et al. *World Report on Child Injury*
293 *Prevention*. Geneva: World Health Organization, 2008.
- 294 6. Nathens AB, Neff MJ, Goss CH, et al. Effect of an older sibling and birth
295 interval on the risk of childhood injury. *Inj Prev* 2000;6:219–22.
- 296 7. Hjern A, Ringback-Weitof G, Andersson R. Socio-demographic risk
297 factors for home-type injuries in Swedish infants and toddlers. *Acta*
298 *Paediatr* 2001;90:61–8.
- 299 8. Petridou E, Anastasiou A, Katsiardanis K, et al. A prospective
300 population-based study of childhood injuries: the Velestino town study. *Eur*
301 *J Public Health* 2005;15:9–14.
- 302 9. Weitof GR, Hjern A, Haglund B, et al. Mortality, severe morbidity, and
303 injury in children living with single parents in Sweden: a population-based
304 study. *Lancet* 2003;361:289–95.
- 305 10. Laursen B, Nielsen JW. Influence of sociodemographic factors on the risk
306 of unintentional childhood home injuries. *Eur J Public Health* 2008;18:366–
307 70.

- 1
2
3
4
5 308 11. Faelker T, Pickett W, Brison RJ. Socioeconomic differences in childhood
6
7 309 injury: a population-based epidemiologic study in Ontario, Canada. *Inj*
8
9 310 *Prev* 2000;6:203–8.
- 10
11 311 12. Laflamme L, Diderichsen F. Social differences in traffic injury risks in
12
13 312 childhood and youth--a literature review and a research agenda. *Inj Prev*
14
15 313 2000;6:293–8.
- 16
17 314 13. de Lourdes Drachler M, de Carvalho Leite JC, Marshall T, et al. Effects of
18
19 315 the home environment on unintentional domestic injuries and related
20
21 316 health care attendance in infants. *Acta Paediatr* 2007;96:1169–73.
- 22
23 317 14. Sekii H, Ohtsu T, Shirasawa T, et al. Childhood mortality due to
24
25 318 unintentional injuries in Japan, 2000–2009. *Int J Environ Res Public Health*
26
27 319 2013;10:528–40.
- 28
29 320 15. Director-General for statistics and information policy, Ministry of Health,
30
31 321 Labour and Welfare. Vital statistics in Japan. Trends up to 2015.
32
33 322 <http://www.mhlw.go.jp/english/database/db-hw/dl/81-1a2en.pdf> (accessed
34
35 323 20 Nov 2017).
- 36
37 324 16. OECD Rights and Translation Unit. Growing Unequal? Income Distribution
38
39 325 and Poverty in OECD Countries. Paris: OECD publications 2008.
- 40
41 326 17. Ministry of Health, Labour and Welfare. Comprehensive Survey of Living
42
43 327 Conditions of the People on Health and Welfare. Tokyo: Ministry of Health,
44
45 328 Labour and Welfare 2016.
- 46
47 329 18. Fujiwara T, Yamaoka Y, Morisaki N. Self-Reported Prevalence and Risk
48
49 330 Factors for Shaking and Smothering Among Mothers of 4-Month-Old
50
51 331 Infants in Japan. *J Epidemiol* 2016;26:4-13.
- 52
53 332 19. Rivara FP, Calonge N, Thompson RS. Population-based study of
54
55 333 unintentional injury incidence and impact during childhood. *Am J Public*

- 1
2
3
4
5 334 *Health* 1989;79:990–4.
6
7 335 20. Engstrom K, Diderichsen F, Laflamme L. Socioeconomic differences in
8
9 336 injury risks in childhood and adolescence: a nation-wide study of
10
11 337 intentional and unintentional injuries in Sweden. *Inj Prev* 2002;8:137–42.
12
13 338 21. Laflamme L, Engstrom K. Socioeconomic differences in Swedish children
14
15 339 and adolescents injured in road traffic incidents: cross sectional study.
16
17 340 *BMJ* 2002;324:396–7.
18
19 341 22. Khatlani K, Alonge O, Rahman A, et al. Caregiver Supervision Practices
20
21 342 and Risk of Childhood Unintentional Injury Mortality in Bangladesh. *Int J*
22
23 343 *Environ Res Public Health* 2017;14(5).
24
25 344 23. Kagamimori S, Gaina A, Nasermoaddeli A. Socioeconomic status and
26
27 345 health in the Japanese population. *Soc Sci Med* 2009;68:2152–60.
28
29 346 24. Nagata T, Setoguchi S, Hemenway D, et al. Effectiveness of a law to
30
31 347 reduce alcohol-impaired driving in Japan. *Inj Prev* 2008;14:19–23.
32
33 348 25. National Police Agency. Trends in traffic accidents by year. Tokyo: Traffic
34
35 349 accidents situation 2016.
36
37 350 26. Ministry of Health, Labour and Welfare. Equal Employment and Child
38
39 351 Welfare. Tokyo: Ministry of Health, Labour and Welfare 2015.
40
41 352 27. Yamamoto N, Honda C, Nagata S. Current trends and age-based
42
43 353 differences of unintentional injury in Japanese children. *Biosci Trends*
44
45 354 2016;10:152–7.
46
47 355 28. Ministry of Internal Affairs and Communications. Information and
48
49 356 Communications in Japan 2017. Tokyo: Ministry of Internal Affairs and
50
51 357 Communications 2017.
52
53 358

STROBE Statement—checklist of items that should be included in reports of observational studies

	Item No	Recommendation	Reported on page #
Title and abstract	1	(a) Indicate the study's design with a commonly used term in the title or the abstract	P1,2
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	p2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	P4
Objectives	3	State specific objectives, including any prespecified hypotheses	P4,5
Methods			
Study design	4	Present key elements of study design early in the paper	P5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	P5
Participants	6	(a) <i>Cohort study</i> —Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up	P5
		<i>Case-control study</i> —Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls	
		<i>Cross-sectional study</i> —Give the eligibility criteria, and the sources and methods of selection of participants	
		(b) <i>Cohort study</i> —For matched studies, give matching criteria and number of exposed and unexposed <i>Case-control study</i> —For matched studies, give matching criteria and the number of controls per case	
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	P5, 6
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	P5,6
Bias	9	Describe any efforts to address potential sources of bias	P5,6
Study size	10	Explain how the study size was arrived at	P6
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	P6
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	P6,7
		(b) Describe any methods used to examine subgroups and interactions	P6,7
		(c) Explain how missing data were addressed	P5
		(d) <i>Cohort study</i> —If applicable, explain how loss to follow-up was addressed <i>Case-control study</i> —If applicable, explain how matching of cases and controls was addressed	P5

Cross-sectional study—If applicable, describe analytical methods taking account of sampling strategy

(e) Describe any sensitivity analyses

Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	P7
		(b) Give reasons for non-participation at each stage	P7
		(c) Consider use of a flow diagram	
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	P7
		(b) Indicate number of participants with missing data for each variable of interest	P7
		(c) <i>Cohort study</i> —Summarise follow-up time (eg, average and total amount)	
Outcome data	15*	<i>Cohort study</i> —Report numbers of outcome events or summary measures over time	
		<i>Case-control study</i> —Report numbers in each exposure category, or summary measures of exposure	
		<i>Cross-sectional study</i> —Report numbers of outcome events or summary measures	P7
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	P10,11
		(b) Report category boundaries when continuous variables were categorized	
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	P16,17,18,19
Discussion			
Key results	18	Summarise key results with reference to study objectives	P21
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	P23,24
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	P21,22,23
Generalisability	21	Discuss the generalisability (external validity) of the study results	P22,23
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	P25

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at www.strobe-statement.org.

For peer review only

BMJ Open

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

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2018-021621.R2
Article Type:	Research
Date Submitted by the Author:	23-Jul-2018
Complete List of Authors:	Sato, Nobuhiro; Niigata University Graduate School of Medicine, Department of Medical Informatics and Statistics Hagiwara, Yusuke; Tokyo Metropolitan Children's Medical Center, Department of Pediatric Emergency and Critical Care Medicine Ishikawa, Junta; Niigata University Graduate School of Medicine, Department of Medical Informatics and Statistics Akazawa, Kouhei; Niigata University Graduate School of Medicine, Department of Medical Informatics and Statistics
Primary Subject Heading:	Epidemiology
Secondary Subject Heading:	Paediatrics, Epidemiology
Keywords:	EPIDEMIOLOGY, PAEDIATRICS, Socioeconomic Status, Risk factor research

SCHOLARONE™
Manuscripts

Only

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

3

4 Nobuhiro Sato^{a)}, Yusuke Hagiwara^{b)}, Junta Ishikawa^{a)}, and Kohei Akazawa^{a)}

5

6 ^a Department of Medical Informatics and Statistics, Niigata University Graduate
7 School of Medicine, Niigata, Japan

8 ^b Department of Pediatric Emergency and Critical Care Medicine, Tokyo
9 Metropolitan Children's Medical Center, Fuchu, Tokyo, Japan

10

11 **Corresponding author:** Nobuhiro Sato, Department of Medical Informatics and
12 Statistics, Niigata University Graduate School of Medicine, 1-754 Asahimachi,
13 Chuo-ku, Niigata 951-8520, Japan. Tel.: +81-25-227-2471. Fax: +81-25-227-0850.
14 E-mail: s_nobuhiro@hosp.niigata.niigata.jp.

15

16 **Word count:** 2096

1
2
3
4
5 **17 ABSTRACT**

6
7 **18 Objectives:** While Japan has socioeconomic issues, such as income inequality,
8
9 **19** little is known about the association between socioeconomic factors and the risk
10
11 **20** of unintentional childhood injuries. The purpose of the study was to evaluate the
12
13 **21** influence of socioeconomic factors on the risk for unintentional injuries among
14
15 **22** preschool children in Japan

16
17 **23 Design:** Cross-sectional study using data from a web-based questionnaire
18
19 **24** survey.

20
21 **25 Setting:** Japan (January 2015).

22
23 **26 Participants:** 1000 households with preschool children under 6 years of age.

24
25 **27 Outcome measures:** Multivariate logistic regression was performed to analyze
26
27 **28** the influence of socioeconomic factors on the incidence of unintentional injuries.

28
29 **29 Results:** Overall, 976 households were eligible for the analysis, with 201
30
31 **30** households reporting unintentional injuries. The incidence rates for unintentional
32
33 **31** injury were estimated to be constant across all strata constructed using
34
35 **32** combinations of socioeconomic factors. The multivariate logistic regression
36
37 **33** analysis showed no significant differences in socioeconomic factors between
38
39 **34** households that reported unintentional injuries and those that did not.

40
41 **35 Conclusion:** The findings of our study demonstrated that unintentional injuries
42
43 **36** among preschool children occurred at approximately fixed rates, independent of
44
45 **37** socioeconomic factors. Accordingly, prevention strategies for unintentional injuries
46
47 **38** that concern socioeconomic disadvantages should be avoided in Japan.

48
49 **39 Keywords:** Epidemiology, Pediatrics, Risk Factor Research, Socioeconomic
50
51 **40** Status

52
53
54
55 **42 'Strengths and limitations of this study'**

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

43 A nationwide questionnaire survey administered in Japan.
44 1000 households with a population distribution similar to that in the national
45 census were included.
46 Confounders by unmeasured factors, such as physical disabilities in children, are
47 study limitations.
48

For peer review only

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
61
62
63
64
65
66
67
68
69
70
71
72
73
74**INTRODUCTION**

Unintentional injuries are a leading cause of death among children of all ages.¹⁻⁴

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 2013.¹ In particular, children aged 1 to 4 years demonstrate the highest all-cause and cause-specific mortality rates due to unintentional injuries.¹ The risks for unintentional injuries among children are mainly defined by individual factors (behaviors and attributes), the presence or absence of supervision, and safety equipment and vehicle safety⁵. Moreover, the risks can be influenced by socioeconomic factors, including family income, parental education, single parenting, maternal age, older siblings, and type of housing.⁶⁻¹³ 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.¹⁰

Similarly, in Japan, unintentional injuries have been a major cause of death among children aged ≥ 1 year since 1960.^{14 15} Furthermore, several socioeconomic issues exist in Japan. For example, Japan is ranked fourth highest for income inequality across the Organization for Economic Cooperation and Development (OECD) member countries.¹⁶ The relative poverty rate for households with children was 12.9% in 2015.¹⁷ A previous study revealed the association between socioeconomic inequality and the risk for infant abuse in Japan.¹⁸ However, only a few studies have examined the relationship between socioeconomic status and unintentional injury among children in Japan thus far.

1
2
3
4
5 75 The purpose of this study was to evaluate the influence of socioeconomic
6
7 76 factors on the risk for unintentional injuries among children in Japan via a
8
9 77 nationwide questionnaire survey.
10

11 78

12 79 **METHODS**

13 80 **Study design and participants**

14
15
16
17 81 This study involved a web-based questionnaire survey. The participants were
18
19 82 selected in January 2015 from a database of 1,370,000 candidates compiled by a
20
21 83 private Japanese company specializing in questionnaire-based research. We
22
23 84 extracted data for 1000 households with preschool children under 6 years of age.
24
25 85 All participants lived in Japan. Region was used as a variable for stratified random
26
27 86 sampling. Hence, the region-wise distribution of our sample was almost identical
28
29 87 to that of the general population in Japan. All respondents completed the
30
31 88 questionnaire on a website developed specially for this study by the survey
32
33 89 company. Exclusion criteria included not living with parents; missing information
34
35 90 regarding parent education and type of housing; and children being cared for by
36
37 91 people other than the parents, grandparents, kindergarten teachers, and nursery
38
39 92 teachers during the daytime. An urban area was defined as an area with >15
40
41 93 million residents. Returning the questionnaire was taken as agreement to
42
43 94 participate in the study and informed consent was obtained from all participants.
44
45 95 This study was approved by the institutional ethics review board of Niigata City
46
47 96 General Hospital.

48 97

49 98 **Measures**

50
51
52 99 The questionnaire included 20 questions about basic and socioeconomic
53
54 100 characteristics and 17 questions concerning unintentional injuries. The following
55
56
57
58
59

1
2
3
4
5 101 socioeconomic factors were used for evaluation: father's age; mother's age; living
6
7 102 area; number of siblings; highest education levels of parents; annual income of
8
9 103 parents; type of housing; parents' employment status; living with grandparents;
10
11 104 primary caregiver during the daytime and at night; use of a sitter, kindergarten, or
12
13 105 nursery school; and history of injuries. Parents were divided into three groups
14
15 106 according to the mean age of mothers (30.7 years old) at the birth of the first child
16
17 107 in Japan: ≤ 29 years, 30–39 years, ≥ 40 years.¹⁵ Highest education level was
18
19 108 classified as junior high school or high school, business technical school or junior
20
21 109 college, and college. Annual income was classified as < 3 million yen, 3–5 million
22
23 110 yen, ≥ 5 million yen, based on the average income in Japan (median 4.28 million
24
25 111 yen).¹⁷ Type of housing was divided into house and apartment house categories.
26
27 112 Injury was defined as physical damage that was fatal or caused aftereffects. We
28
29 113 included the following types of injuries: all injuries, such as falls from stairs or a
30
31 114 balcony; burns from hot liquids, hot surfaces, or fire; accidental poisoning; foreign
32
33 115 body aspiration or suffocation; drowning; and traffic injuries.¹⁰ The information
34
35 116 collected about unintentional injuries included gender of child, time, place of injury,
36
37 117 witnessed by others or not, and management after injury. The injury mechanism
38
39 118 was defined as the injury that the respondent considered to be the most severe
40
41 119 when the child experienced multiple unintentional injuries.
42

120

121 **Statistical Analysis**

122 The sample size calculation was performed on the basis of a statistical power of
123 80%, two-sided P-value of 0.05, an event rate of 25%, and a relative risk of
124 socioeconomic disadvantage of 1.2, obtained from previous studies.^{8 10 19}

125 Continuous data with skewed distributions are shown as medians and
126 interquartile ranges, and categorical data as proportions. The Pearson's

1
2
3
4
5 127 chi-squared test or Fisher's exact test was used to explore the significance of
6
7 128 differences between households reporting unintentional injuries and those that did
8
9 129 not report any injuries.

10
11 130 Multiple logistic regression analysis was used to estimate the odds ratios and
12
13 131 95% confidence intervals (CIs) after controlling simultaneously for potential
14
15 132 confounders. We used unintentional injury as the dependent variable. We
16
17 133 included 15 significant risk factors in the analysis (family type, age of parents,
18
19 134 education of parents, number of children, presence of infant or older siblings,
20
21 135 living with grandparent, parents' employment status, use of sitter, kindergarten, or
22
23 136 nursery school, type of housing, and annual income). All statistical tests were
24
25 137 two-sided. A p-value less than 0.05 was considered statistically significant. Data
26
27 138 analysis was performed using SPSS, version 23.0 (IBM Corporation, Armonk, NY,
28
29 139 USA).

30
31 140

32 141 **Patient and Public Involvement**

33
34
35 142 Patients and public were not involved in the design of the study.
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

143

144 **RESULTS**145 **Characteristics of the study population**

146 Of the 1000 households that participated in this study, 24 families were
 147 excluded because of missing data regarding the parents' education (n=2); type of
 148 housing (n=17); and primary caregivers apart from parents, grandparents,
 149 kindergarten teachers, and nursery school teachers during the daytime (n=5).
 150 Table 1 shows the basic characteristics of the 976 households that were included
 151 in the study. The median age of the respondents was 38 years (interquartile range
 152 33–42 years). In total, 201 households reported unintentional injuries among
 153 children. Table 2 presents the distribution of the 201 unintentionally injured
 154 children according to injury-descriptive variables. The most frequently observed
 155 mechanism of injury was falls (58.2%), followed by burns (23.4%),
 156 poisoning/aspiration (6.0%), drowning (3.0%), traffic injury (3.5%), and others
 157 (6.0%).

158

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

Factors	N=976	%
Respondent		
Mother	569	58.3
Father	407	41.7
Region		
Urban area	678	69.5
Others	298	30.5

1			
2			
3			
4			
5	Family type		
6			
7	Two parents	936	95.9
8			
9	Single parent	40	4.1
10			
11	Number of children		
12			
13	1	375	38.4
14			
15	2	447	45.8
16			
17	≥3	154	15.8
18			
19	Living with grandparent		
20			
21	Yes	389	39.9
22			
23	No	587	60.1
24			
25	Use of sitter, kindergarten, or nursery school		
26			
27	Yes	197	20.2
28			
29	No	779	79.8
30			
31	Type of housing		
32			
33	House	516	52.9
34			
35	Apartment	460	47.1
36			
37	Annual income		
38			
39	<3 million	117	12.0
40			
41	3–5 million	366	37.5
42			
43	>5 million	493	50.5
44			
45	Unintentional injury		
46			
47	Yes	201	20.6
48			
49	No	775	79.4
50			
51			

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

Factors	n=201	%
Injury mechanism (multiple answers)		
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
Gender of child		
Male	119	59.2
Female	82	40.8
Time of injury		
Daytime on a weekday	106	52.7
Nighttime on a weekday	64	31.8
Holiday	31	15.4
Place of injury		
Home	188	93.5
Outdoor	13	6.5
Witnessed by caregivers		
Yes	129	64.2
No	72	35.8
Management after injury		
Visit hospital	112	55.7

Observation at home	88	43.8
Others	1	0.5

160

161 **Risk factors for unintentional injury among pre-school children in Japan**

162 Table 3 shows the incidence rates of 15 socioeconomic factors. The incidence
 163 of unintentional injury was estimated at approximately 21% with or without the
 164 presence of socioeconomic disadvantage. The risk for unintentional injuries was
 165 higher among preschool children with high-school graduate fathers and those in
 166 families with more siblings. However, there were no significant differences in
 167 incident rates of unintentional injuries across all groups. Table 4 shows the
 168 association between socioeconomic factors and timing of injury. Table 5 shows
 169 the association between socioeconomic factors and management after injury.
 170 Consistent with the main results, there was no relationship between
 171 socioeconomic factors and the variables in these tables.

172 The results of the multivariate analysis are shown in Table 6. Between
 173 households reporting unintentional injuries and those that did not report any, no
 174 significant differences in terms of income of parents were observed in the incident
 175 rates of unintentional injuries among preschool children (adjusted odds ratio, 0.90;
 176 95% CI 0.53–1.53; $p=0.701$). Similarly, there were no significant differences in the
 177 other socioeconomic factors in terms of the incident rates of unintentional injuries
 178 among preschool children.

179

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

Factors	Overall (n=976)	Unintentional injury												p-value		
		Fall (n=117)	%* 12.0	Burn (n=47)	%* 5.0	Poisoning/ Aspiration (n=12)	%* 1.3	Drowning (n=6)	%* 0.6	Traffic injury (n=7)	%* 0.6	Others (n=12)	%* 1.3		Total (n=201)	%* 20.8
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	
Age of mother																p=0.635
<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	
Older siblings (>6 years old)																p=0.330
Yes	374	47	12.6	22	5.9	5	1.3	1	0.3	4	1.1	4	1.1	83	22.2	

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																	p=0.933
Yes	128	14	10.9	7	5.5	0	0.0	1	0.8	1	0.8	3	2.3	26	20.3		
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																	p=0.466
Yes	362	47	13.0	19	5.2	4	1.1	2	0.6	1	0.3	6	1.7	79	21.8		
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																	p=0.574
Employed	391	52	13.3	19	4.9	3	0.8	1	0.3	4	1.0	5	1.3	84	21.5		
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																	p=0.463
Employed	964	114	11.8	47	4.9	12	1.2	6	0.6	7	0.7	12	1.2	198	20.5		
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																	p=0.143
Yes	197	32	16.2	9	4.6	2	1.0	0	0.0	2	1.0	3	1.5	48	24.4		
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																	p=0.554
House	516	66	12.8	28	5.4	2	0.4	2	0.4	4	0.8	8	1.6	110	21.3		
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																	p=0.855
<3 million	117	15	12.8	5	4.3	2	1.7	0	0.0	1	0.9	2	1.7	25	21.4		

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

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

181 † The Pearson’s chi-squared test or Fisher’s exact test for total number of unintentional injuries

182

183

Table 4 Time of unintentional injuries among children and socioeconomic factors

Factors	Overall (n=976)	Unintentional injury							
		Daytime on a weekday (n=106)		Nighttime on a weekday (n=64)		Holiday (n=31)		Total (n=201)	
			%*		%*		%*		%*
Family type									
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
Age of mother									
<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
Age of father									
<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
Education of mother									
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
Education of father									
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
Number of children									
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
Infant (<1 year old)									
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	
Older siblings (>6 years old)										
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	
Living with grandmother										
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	
Living with grandfather										
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	
Mother's employment status										
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	
Father's employment status										
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	
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

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

185

Table 5 Management after unintentional injuries among children and socioeconomic factors

Factors	Overall (n=976)		Unintentional injury						
	Visit hospital (n=112)	%*	Observation at home (n=88)	%*	Others (n=1)	%*	Total (n=201)	%*	
Family type									
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
Age of mother									
<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

Age of father									
<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
Education of mother									
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
Education of father									
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
Number of children									
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

1										
2										
3										
4										
5										
6										
7										
8	Infant (<1 year old)									
9	Yes	170	13	7.6	18	10.6	0	0.0	31	18.2
10	No	806	99	12.3	70	8.7	1	0.1	170	21.1
11										
12	Older siblings (>6 years old)									
13	Yes	374	55	14.7	28	7.5	0	0.0	83	22.2
14	No	602	57	9.5	60	10.0	1	0.2	118	19.6
15										
16	Living with grandmother									
17	Yes	128	13	10.2	13	10.2	0	0.0	26	20.3
18	No	848	99	11.7	75	8.8	1	0.1	175	20.6
19										
20	Living with grandfather									
21	Yes	362	44	12.2	35	9.7	0	0.0	79	21.8
22	No	614	68	11.1	53	8.6	1	0.2	122	19.9
23										
24	Mother's employment status									
25	Employed	391	53	13.6	31	7.9	0	0.0	84	21.5
26	Unemployed	585	59	10.1	57	9.7	1	0.2	117	20.0
27										
28	Father's employment status									
29	Employed	964	110	11.4	87	9.0	1	0.1	198	20.5
30	Unemployed	12	2	16.7	1	8.3	0	0.0	3	25.0
31										
32	Use of sitter, kindergarten, or nursery school									
33	Yes	197	32	16.2	16	8.1	0	0.0	48	24.4
34	No	779	80	10.3	72	9.2	1	0.1	153	19.6
35										
36										
37										
38										
39										
40										
41										
42										
43										
44										
45										
46										
47										

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47

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									
<3 million	117	14	12.0	11	9.4	0	0.0	25	21.4
3–5 million	366	36	9.8	41	11.2	1	0.3	78	21.3
>5 million	493	62	12.6	36	7.3	0	0.0	98	19.9

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

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

Factors	Odds ratio	95% CI	p-value
Family type	0.60	(0.23–1.53)	0.283
Age of mother			0.433
<29 years	1	(reference)	
30–39 years	0.68	(0.37–1.22)	0.196
≥40 years	0.69	(0.34–1.37)	0.285
Age of father			0.849
<29 years	1	(reference)	
30–39 years	1.23	(0.58–2.61)	0.596
≥40 years	1.27	(0.56–2.85)	0.570
Education of mother			0.284
High school	1	(reference)	
Business technical school or junior college	1.20	(0.82–1.82)	0.334
College	0.90	(0.57–1.40)	0.629
Education of father			0.504
High school	1	(reference)	
Business technical school or junior college	0.78	(0.47–1.29)	0.339
College	0.81	(0.54–1.21)	0.299
Number of children			0.168
1	1	(reference)	
2	1.51	(0.98–2.31)	0.059
≥3	1.49	(0.79–2.79)	0.215

1				
2				
3				
4				
5	Infant (<1 year old)	0.78	(0.49–1.23)	0.278
6				
7	Older siblings (>6 years old)	0.91	(0.58–1.43)	0.682
8				
9	Living with grandmother	0.87	(0.52–1.47)	0.606
10				
11	Living with grandfather	1.17	(0.83–1.65)	0.383
12				
13	Mother's employment status	0.99	(0.67–1.47)	0.976
14				
15	Father's employment status	0.79	(0.20–3.12)	0.737
16				
17	Use of sitter, kindergarten, or nursery school	1.38	(0.88–2.16)	0.165
18				
19	Type of housing	0.97	(0.69–1.36)	0.836
20				
21	Annual income (Yen)			0.849
22				
23	<3 million	1	(reference)	
24				
25	3–5 million	0.99	(0.58–1.69)	0.977
26				
27	>5 million	0.90	(0.53–1.53)	0.701

187 CI, confidence interval

188 DISCUSSION

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

193 Our data showed that households whose annual income was under 3
 194 million yen accounted for 12.0% of the population, whereas the relative poverty
 195 rate for households with children was 12.9% in Japan.¹⁷ The incidence rate of
 196 unintentional injuries observed in our study is not very different from that reported
 197 in other studies: 29.0 injuries per 100 children over a period of 1 year within a
 198 population of 0–4-year-old children in a Greek town and 17.4 medically treated
 199 injuries within a population of 0–4-year-old children and adolescents in a health
 200 maintenance organization.^{8 19}

1
2
3
4
5 201 Nevertheless, our results differ from the outcomes reported in other
6
7 202 studies of the relationship between unintentional injuries and socioeconomic
8
9 203 factors.^{7 10 12} There are several explanations for these results. First, the younger
10
11 204 age of children may affect the relationship between the risk for unintentional
12
13 205 injuries and socioeconomic factors. A previous study showed very minor
14
15 206 socioeconomic differences in the injury risk among 0–4-year-old children in
16
17 207 Sweden.²⁰ However, socioeconomic differences were observed for traffic injury
18
19 208 risk from the age of 5 years onwards.²⁰ Another study reported that the relative
20
21 209 risk of being injured in a road traffic incident is higher for 5–19-year-olds with low
22
23 210 socioeconomic status than for those with higher socioeconomic status.²¹
24
25 211 Alternatively, caregiver supervision might modify the association between
26
27 212 unintentional injury and socioeconomic factors in younger ages, because the
28
29 213 proportion of injuries witnessed by caregivers was high in our study. A previous
30
31 214 study suggested lack of supervision made children under 5 years at risk of high
32
33 215 mortality by unintentional injuries.²² Therefore, the age of the children, which was
34
35 216 under 6 years old in our study, might help to decrease the risk of unintentional
36
37 217 injuries in lower socioeconomic status families. Second, the following
38
39 218 characteristics specific to Japan might reduce the socioeconomic differences:
40
41 219 relatively low exposure to environmental hazards, the social support network, and
42
43 220 ethnic homogeneity.²³ The absolute number of traffic accidents in Japan has
44
45 221 gradually decreased from 887000 in 2006 to 499000 in 2016, owing to new road
46
47 222 traffic laws and improvements in the quality of roads, vehicle engineering, and
48
49 223 driver behavior.^{24 25} The Japanese government provides households with children
50
51 224 allowances according to income, employment or financial support for single parent
52
53 225 families, and visits for all families with infants.²⁶ All municipalities in Japan conduct
54
55 226 health checkups at healthcare centers for children aged 18–23 months and
56
57
58
59
60

1
2
3
4
5 227 children aged 36–47 months, despite socioeconomic differences. The mean
6
7 228 response rate for these health checkups is over 90%.²⁷

8
9 229 Taken together, our data and those from previous studies, confirm that
10
11 230 the relationship between unintentional injury and socioeconomic factors differs for
12
13 231 each nation.^{6-8 10 11 13 28 29} It is difficult to generalize the influence of
14
15 232 socioeconomic factors on the risk of unintentional childhood injuries. Therefore,
16
17 233 prevention strategies should vary from country to country. In Japan, prevention
18
19 234 strategies that focus on socioeconomic disadvantages would be inadequate. A
20
21 235 comprehensive approach that involves health checkups could be a useful method
22
23 236 for prevention of unintentional injuries.

24
25 237

26 27 238 **Limitations**

28
29 239 This study had several limitations. First, only those households that had
30
31 240 access to the internet were included. However, we selected households with a
32
33 241 population distribution similar to that in the national census. We had a high
34
35 242 internet penetration rate of the general population (83.5%) in Japan.³⁰ In addition,
36
37 243 there were no differences between the relative poverty rates recorded in our study
38
39 244 and those for the whole nation. Second, the outcome measures were based on
40
41 245 self-reporting. The respondents may have been unaware of incidences of
42
43 246 unintentional injury, or recalled the accident inaccurately. Thus, the incidence of
44
45 247 unintentional injury might be underestimated. However, the incident rates
46
47 248 recorded in our study are not very different from those obtained in other studies.
48
49 249 Third, although we excluded households which had missing information regarding
50
51 250 parent education and type of housing, this might have resulted in bias due to
52
53 251 missing data. However, we excluded only 24 households. Additionally, the risk of
54
55 252 unintentional injury was similar, despite of the high proportion of single parents in

1
2
3
4
5 253 the missing data. Thus, it might not impact the validity of the conclusion. Finally,
6
7 254 our inferences might be confounded by unmeasured factors, such as gender,
8
9 255 mental health conditions, and physical disability of the children. Future studies
10
11 256 should measure the non-socioeconomic factors relating to unintentional injuries
12
13 257 among children more explicitly.
14

15 258

16 259 **Conclusion**

17
18 260 Unintentional injuries among preschool children occurred at approximately
19
20 261 constant rates irrespective of the presence of socioeconomic factors. The
21
22 262 association between socioeconomic factors and unintentional injury varies across
23
24 263 different countries. Prevention strategies aimed at unintentional injuries that take
25
26 264 socioeconomic disadvantages into consideration may not be applicable in Japan.
27

28
29 265
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

1
2
3
4
5 266 **CONTRIBUTORSHIP STATEMENT**

6
7 267 NS conceived the study. YH, JI and KA supervised the conduct of the trial
8
9 268 and data collection. NS managed the data, including quality control. KA provided
10
11 269 statistical advice on the study design and analyzed the data; NS chaired the data
12
13 270 oversight committee. NS, YH, and KA drafted the manuscript, and all authors
14
15 271 contributed substantially to its revision. NS takes responsibility for the paper as a
16
17 272 whole. All authors read and approved the final manuscript.
18

19 273

20
21 274 **COMPETING INTERESTS**

22
23 275 None declared.
24

25 276

26
27 277 **FUNDING**

28
29 278 This research received no specific grant from any funding agency in the
30
31 279 public, commercial or not-for-profit sectors.
32

33 280

34
35 281 **DATA SHARING STATEMENT**

36
37 282 The database set was available for all authors of the study, and will be available
38
39 283 for other non-commercial researchers on request.
40

41 284
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

285

286 **References**

- 287 1. Alonge O, Khan UR, Hyder AA. Our Shrinking Globe: Implications for Child
288 Unintentional Injuries. *Pediatr Clin North Am* 2016;63:167–81.
- 289 2. Alonge O, Hyder AA. Reducing the global burden of childhood
290 unintentional injuries. *Arch Dis Child* 2014;99:62–9.
- 291 3. Hyder AA, Wali S, Fishman S, et al. The burden of unintentional injuries
292 among the under-five population in South Asia. *Acta Paediatr*
293 2008;97:267–75.
- 294 4. Krug EG, Sharma GK, Lozano R. The global burden of injuries. *Am J*
295 *Public Health* 2000;90:523–6.
- 296 5. Peden M, Oyegbite K, Ozanne-Smith J, et al. *World Report on Child Injury*
297 *Prevention*. Geneva: World Health Organization, 2008.
- 298 6. Nathens AB, Neff MJ, Goss CH, et al. Effect of an older sibling and birth
299 interval on the risk of childhood injury. *Inj Prev* 2000;6:219–22.
- 300 7. Hjern A, Ringback-Weitof G, Andersson R. Socio-demographic risk factors
301 for home-type injuries in Swedish infants and toddlers. *Acta Paediatr*
302 2001;90:61–8.
- 303 8. Petridou E, Anastasiou A, Katsiardanis K, et al. A prospective
304 population-based study of childhood injuries: the Velestino town study. *Eur*
305 *J Public Health* 2005;15:9–14.
- 306 9. Weitof GR, Hjern A, Haglund B, et al. Mortality, severe morbidity, and
307 injury in children living with single parents in Sweden: a population-based
308 study. *Lancet* 2003;361:289–95.
- 309 10. Laursen B, Nielsen JW. Influence of sociodemographic factors on the risk
310 of unintentional childhood home injuries. *Eur J Public Health*

- 1
2
3
4
5 311 2008;18:366–70.
6
7 312 11. Faelker T, Pickett W, Brison RJ. Socioeconomic differences in childhood
8
9 313 injury: a population-based epidemiologic study in Ontario, Canada. *Inj*
10
11 314 *Prev* 2000;6:203–8.
12
13 315 12. Laflamme L, Diderichsen F. Social differences in traffic injury risks in
14
15 316 childhood and youth--a literature review and a research agenda. *Inj Prev*
16
17 317 2000;6:293–8.
18
19 318 13. de Lourdes Drachler M, de Carvalho Leite JC, Marshall T, et al. Effects of
20
21 319 the home environment on unintentional domestic injuries and related
22
23 320 health care attendance in infants. *Acta Paediatr* 2007;96:1169–73.
24
25 321 14. Sekii H, Ohtsu T, Shirasawa T, et al. Childhood mortality due to
26
27 322 unintentional injuries in Japan, 2000–2009. *Int J Environ Res Public Health*
28
29 323 2013;10:528–40.
30
31 324 15. Director-General for statistics and information policy, Ministry of Health,
32
33 325 Labour and Welfare. Vital statistics in Japan. Trends up to 2015.
34
35 326 <http://www.mhlw.go.jp/english/database/db-hw/dl/81-1a2en.pdf> (accessed
36
37 327 20 Nov 2017).
38
39 328 16. OECD Rights and Translation Unit. Growing Unequal? Income Distribution
40
41 329 and Poverty in OECD Countries. Paris: OECD publications 2008.
42
43 330 17. Ministry of Health, Labour and Welfare. Comprehensive Survey of Living
44
45 331 Conditions of the People on Health and Welfare. Tokyo: Ministry of Health,
46
47 332 Labour and Welfare 2016.
48
49 333 18. Fujiwara T, Yamaoka Y, Morisaki N. Self-Reported Prevalence and Risk
50
51 334 Factors for Shaking and Smothering Among Mothers of 4-Month-Old
52
53 335 Infants in Japan. *J Epidemiol* 2016;26:4-13.
54
55 336 19. Rivara FP, Calonge N, Thompson RS. Population-based study of
56
57
58
59
60

- 1
2
3
4
5 337 unintentional injury incidence and impact during childhood. *Am J Public*
6
7 338 *Health* 1989;79:990–4.
- 8
9 339 20. Engstrom K, Diderichsen F, Laflamme L. Socioeconomic differences in
10
11 340 injury risks in childhood and adolescence: a nation-wide study of
12
13 341 intentional and unintentional injuries in Sweden. *Inj Prev* 2002;8:137–42.
- 14
15 342 21. Laflamme L, Engstrom K. Socioeconomic differences in Swedish
16
17 343 children and adolescents injured in road traffic incidents: cross sectional
18
19 344 study. *BMJ* 2002;324:396–7.
- 20
21 345 22. Khatlani K, Alonge O, Rahman A, et al. Caregiver Supervision Practices
22
23 346 and Risk of Childhood Unintentional Injury Mortality in Bangladesh. *Int J*
24
25 347 *Environ Res Public Health* 2017;14(5).
- 26
27 348 23. Kagamimori S, Gaina A, Naser Moaddeli A. Socioeconomic status and
28
29 349 health in the Japanese population. *Soc Sci Med* 2009;68:2152–60.
- 30
31 350 24. Nagata T, Setoguchi S, Hemenway D, et al. Effectiveness of a law to
32
33 351 reduce alcohol-impaired driving in Japan. *Inj Prev* 2008;14:19–23.
- 34
35 352 25. National Police Agency. Trends in traffic accidents by year. Tokyo: Traffic
36
37 353 accidents situation 2016.
- 38
39 354 26. Ministry of Health, Labour and Welfare. Equal Employment and Child
40
41 355 Welfare. Tokyo: Ministry of Health, Labour and Welfare 2015.
- 42
43 356 27. Yamamoto N, Honda C, Nagata S. Current trends and age-based
44
45 357 differences of unintentional injury in Japanese children. *Biosci Trends*
46
47 358 2016;10:152–7.
- 48
49 359 28. Chowdhury AH, Hanifi SMA, Mia MN, et al. Socioeconomic inequalities in
50
51
52 360 under-five mortality in rural Bangladesh: evidence from seven national
53
54
55 361 surveys spreading over 20 years. *Int J Equity Health* 2017;16(1):197.

- 1
2
3
4
5 362 29. Fang X, Jing R, Zeng G, et al. Socioeconomic status and the incidence of
6
7 363 child injuries in China. *Soc Sci Med* 2014;102:33-40.
8
9 364 30. Ministry of Internal Affairs and Communications. Information and
10
11 365 Communications in Japan 2017. Tokyo: Ministry of Internal Affairs and
12
13 366 Communications 2017.
14
15 367

For peer review only

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

STROBE Statement—checklist of items that should be included in reports of observational studies

	Item No	Recommendation	Reported on page #
Title and abstract	1	(a) Indicate the study's design with a commonly used term in the title or the abstract	P1,2
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	p2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	P4
Objectives	3	State specific objectives, including any prespecified hypotheses	P4,5
Methods			
Study design	4	Present key elements of study design early in the paper	P5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	P5
Participants	6	(a) <i>Cohort study</i> —Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up	P5
		<i>Case-control study</i> —Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls	
		<i>Cross-sectional study</i> —Give the eligibility criteria, and the sources and methods of selection of participants	
		(b) <i>Cohort study</i> —For matched studies, give matching criteria and number of exposed and unexposed	
		<i>Case-control study</i> —For matched studies, give matching criteria and the number of controls per case	
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	P5, 6
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	P5,6
Bias	9	Describe any efforts to address potential sources of bias	P5,6
Study size	10	Explain how the study size was arrived at	P6
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	P6
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	P6,7
		(b) Describe any methods used to examine subgroups and interactions	P6,7
		(c) Explain how missing data were addressed	P5
		(d) <i>Cohort study</i> —If applicable, explain how loss to follow-up was addressed	P5
		<i>Case-control study</i> —If applicable, explain how matching of cases and controls was addressed	
		<i>Cross-sectional study</i> —If applicable, describe analytical methods taking account of sampling strategy	

(e) Describe any sensitivity analyses

Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	P8
		(b) Give reasons for non-participation at each stage	P8
		(c) Consider use of a flow diagram	
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	P8
		(b) Indicate number of participants with missing data for each variable of interest	P8
		(c) <i>Cohort study</i> —Summarise follow-up time (eg, average and total amount)	
Outcome data	15*	<i>Cohort study</i> —Report numbers of outcome events or summary measures over time	
		<i>Case-control study</i> —Report numbers in each exposure category, or summary measures of exposure	
		<i>Cross-sectional study</i> —Report numbers of outcome events or summary measures	P8
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	P11
		(b) Report category boundaries when continuous variables were categorized	
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	P12-21
Discussion			
Key results	18	Summarise key results with reference to study objectives	P23
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	P25,26
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	P23,24,25
Generalisability	21	Discuss the generalisability (external validity) of the study results	P24
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	P27

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

1
2
3
4 **Note:** An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE
5 checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at
6 <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at www.strobe-statement.org.
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47

For peer review only