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

Nobuhiro Sato[a)], Yusuke Hagiwara[b)], Junta Ishikawa[a)], and Kohei Akazawa[a)]

[a] Department of Medical Informatics and Statistics, Niigata University Graduate School of Medicine, Niigata, Japan

[b] Department of Pediatric Emergency and Critical Care Medicine, Tokyo Metropolitan Children's Medical Center, Fuchu, Tokyo, Japan

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

**Word count:** 1804

## ABSTRACT

**Objectives:** To evaluate the influence of socioeconomic factors on the risk for unintentional injuries among preschool children in Japan

**Methods:** We used data from a web-based questionnaire survey that was sent to 1000 households with preschool children under 6 years of age. Multivariate logistic regression was performed to analyze the influence of socioeconomic factors on the incidence of unintentional injuries.

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

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

**Keywords:** Epidemiology, Pediatrics, Risk Factor Research, Socioeconomic Status

## 'Strengths and limitations of this study'

This study evaluated the influence of socioeconomic factors on the risk for unintentional injuries among children in Japan via a nationwide questionnaire survey.

We selected 1000 households with a population distribution similar to that in the national census.

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

## 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.

The purpose of this study was to evaluate the influence of socioeconomic factors on the risk for unintentional injuries among children in Japan via a nationwide questionnaire survey.

## METHODS

### Study design and participants

This study involved a web-based questionnaire survey. The participants were selected in January 2015 from a database of 1,370,000 candidates compiled by a private Japanese company specializing in questionnaire-based research. We extracted data for 1000 households with preschool children under 6 years of age. All participants lived in Japan. Region was used as a variable for stratified random sampling. Hence, the region-wise distribution of our sample was almost identical to that of the general population in Japan. All respondents completed the questionnaire on a website developed specially for this study by the survey company. Exclusion criteria included not living with parents; missing information regarding parent education and type of housing; and children being cared for by people other than the parents, grandparents, kindergarten teacher, and nursery teacher in the daytime. An urban area was defined as an area with >15 million residents. Returning the questionnaire was taken as agreement to participate in the study and informed consent was obtained from all participants. This study was approved by the institutional ethics review board of Niigata City General Hospital.

### Measures

The following socioeconomic factors were used for evaluation: father's age; mother's age; living area; number of siblings; highest education levels of parents; annual income of parents; type of housing; maternal employment; living

with grandparents; use of a sitter, kindergarten, or nursery school; and history of injuries. Parents were divided into three groups according to the mean age of mothers (30.7 years old) at the birth of the first child in Japan: ≤29 years, 30–39 years, ≥40 years.[15] Highest education level was classified as junior high school or high school, business technical school or junior college, and college. Annual income was classified as <3 million yen, 3–5 million yen, ≥5 million yen, based on the average income in Japan (median 4.28 million yen).[17] Type of housing was divided into house and apartment house categories. Injury was defined as physical damage that is fatal or causes aftereffects. We included the following types of injuries: injuries caused by falls from stairs or a balcony; burns from hot liquids, hot surfaces, or fire; accidental poisoning; foreign body aspiration or suffocation; drowning; and traffic injuries.[10] The question on injury mechanism allowed multiple answers.

**Statistical Analysis**

Continuous data with skewed distributions are shown as medians and interquartile ranges, and categorical data as proportions. The Pearson's chi-squared test was used to explore the significance of differences between households reporting unintentional injuries and those that did not report any injuries.

Multiple logistic regression analysis was used to estimate the odds ratios and 95% confidence intervals (CIs) after controlling simultaneously for potential confounders. We included 14 significant risk factors in the analysis (Family type, Age of parents, Education of parents, Number of children, Presence of infant or older siblings, Living with grandparent, Mother's employment status, Use of sitter, kindergarten, or nursery school, Type of housing, and Annual income). All

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

## RESULTS

### Characteristics of the study population

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

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 |

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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 |

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

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

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

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

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 | |

| | | | | |
|---|---|---|---|---|
| Education of mother | | | | p=0.160 |
| High school | 277 | 58 | 20.9 | |
| Business technical school or junior college | 351 | 82 | 23.4 | |
| College | 348 | 61 | 17.5 | |
| Education of father | | | | p=0.200 |
| High school | 281 | 68 | 24.2 | |
| Business technical school or junior college | 150 | 30 | 20.0 | |
| College | 545 | 103 | 18.9 | |
| Number of children | | | | p=0.138 |
| 1 | 375 | 65 | 17.3 | |
| 2 | 447 | 101 | 22.6 | |
| ≥3 | 154 | 35 | 22.7 | |
| Infant (<1 year old) | | | | p=0.403 |
| Yes | 170 | 31 | 18.2 | |
| No | 806 | 170 | 21.1 | |
| Older siblings (>6 years old) | | | | p=0.330 |
| Yes | 374 | 83 | 22.2 | |
| No | 602 | 118 | 19.6 | |
| Living with grandmother | | | | p=0.933 |
| Yes | 128 | 26 | 20.3 | |
| No | 848 | 175 | 20.6 | |
| Living with grandfather | | | | p=0.466 |
| Yes | 362 | 79 | 21.8 | |
| No | 614 | 122 | 19.9 | |

| | | | | |
|---|---|---|---|---|
| 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 | |

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 |

## DISCUSSION

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

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

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

children in Sweden.[19] However, socioeconomic differences were observed for traffic injury risk from the age of 5 years onwards.[19] Another study reported that the relative risk of being injured in a road traffic incident is higher for 5–19-year-olds belonging to a low social class than for those belonging to other social classes.[20] The age of the children, which was under 6 years old in our study, may help to explain the disadvantage of lower socioeconomic classes. Finally, the following characteristics specific to Japan might reduce the socioeconomic differences: relatively low exposure to environmental hazards, the social support network, and ethnic homogeneity.[21] The absolute number of traffic accidents in Japan has gradually decreased from 887000 in 2006 to 499000 in 2016, owing to new road traffic laws and improvements in the quality of roads, vehicle engineering, and driver behavior.[22, 23] The Japanese government provides households with children's allowances according to income, employment or financial support for single parent families, and visits for all families with infants.[24] All municipalities in Japan conduct health checkups at healthcare centers for children aged 18–23 months and children aged 36–47 months despite socioeconomic differences. The mean response rate for these health checkups is over 90%.[25]

Taken together, our data and those from previous studies, confirm that the relationship between unintentional injury and socioeconomic factors differs for each nation.[7, 8, 10, 11] It is difficult to generalize the influence of socioeconomic factors on the risk for unintentional childhood injuries. Therefore, prevention strategies should vary from country to country. In Japan, prevention strategies that consider socioeconomic disadvantages would be inadequate. A comprehensive approach that involves health checkups could be a useful method for prevention of unintentional injuries.

## Limitations

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

## Conclusion

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

## CONTRIBUTORSHIP STATEMENT

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

## COMPETING INTERESTS

None declared.

## FUNDING

We did not receive any specific funding for the study.

## DATA SHARING STATEMENT

No additional data are available.

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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*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up<br>*Case-control study*—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<br>*Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants | P5 |
| | | (*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed<br>*Case-control study*—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*) *Cohort study*—If applicable, explain how loss to follow-up was addressed<br>*Case-control study*—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) *Cohort study*—Summarise follow-up time (eg, average and total amount) | |
| Outcome data | 15* | *Cohort study*—Report numbers of outcome events or summary measures over time | |
| | | *Case-control study*—Report numbers in each exposure category, or summary measures of exposure | |
| | | *Cross-sectional study*—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.

**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.

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

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

Nobuhiro Sato[a)], Yusuke Hagiwara[b)], Junta Ishikawa[a)], and Kohei Akazawa[a)]

[a] Department of Medical Informatics and Statistics, Niigata University Graduate School of Medicine, Niigata, Japan

[b] Department of Pediatric Emergency and Critical Care Medicine, Tokyo Metropolitan Children's Medical Center, Fuchu, Tokyo, Japan

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

**Word count:** 2346

## ABSTRACT

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

**Methods:** We used data from a web-based questionnaire survey that was sent to 1000 households with preschool children under 6 years of age. Multivariate logistic regression was performed to analyze the influence of socioeconomic factors on the incidence of unintentional injuries.

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

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

**Keywords:** Epidemiology, Pediatrics, Risk Factor Research, Socioeconomic Status

## 'Strengths and limitations of this study'

This study evaluated the influence of socioeconomic factors on the risk of unintentional injuries among children in Japan via a nationwide questionnaire survey.

We selected 1000 households with a population distribution similar to that in the national census.

Although multiple logistic regression analysis was used, our inferences might be confounded by unmeasured factors, such as physical disability of the children.

## 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, 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.

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

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

## METHODS

### Study design and participants

This study involved a web-based questionnaire survey. The participants were selected in January 2015 from a database of 1,370,000 candidates compiled by a private Japanese company specializing in questionnaire-based research. We extracted data for 1000 households with preschool children under 6 years of age. All participants lived in Japan. Region was used as a variable for stratified random sampling. Hence, the region-wise distribution of our sample was almost identical to that of the general population in Japan. All respondents completed the questionnaire on a website developed specially for this study by the survey company. Exclusion criteria included not living with parents; missing information regarding parent education and type of housing; and children being cared for by people other than the parents, grandparents, kindergarten teachers, and nursery teachers during the daytime. An urban area was defined as an area with >15 million residents. Returning the questionnaire was taken as agreement to participate in the study and informed consent was obtained from all participants. This study was approved by the institutional ethics review board of Niigata City General Hospital.

### Measures

The questionnaire included 20 questions about basic and socioeconomic characteristics and 17 questions concerning unintentional injuries. The following socioeconomic factors were used for evaluation: father's age; mother's age; living

area; number of siblings; highest education level of parents; annual income of parents; type of housing; parents' employment status; living with grandparents; primary caregiver during the daytime and at night; use of a sitter, kindergarten, or nursery school; and history of injuries. Parents were divided into three groups according to the mean age of mothers (30.7 years old) at the birth of the first child in Japan: ≤29 years, 30–39 years, ≥40 years.[15] Highest education level was classified as junior high school or high school, business technical school or junior college, and college. Annual income was classified as <3 million yen, 3–5 million yen, and ≥5 million yen, based on the average income in Japan (median 4.28 million yen).[17] Type of housing was divided into house and apartment categories. Injury was defined as physical damage that is fatal or causes aftereffects. We included the following types of injuries: all injuries, such as falls from stairs or a balcony; burns from hot liquids, hot surfaces, or fire; accidental poisoning; foreign body aspiration or suffocation; drowning; and traffic injuries.[10] The information collected about unintentional injuries included gender of child, time, place of injury, witnessed by others or not, and management after injury. The injury mechanism was defined as the injury that the respondent considered to be the most severe.

**Statistical Analysis**

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

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

not report any injuries.

Multiple logistic regression analysis was used to estimate the odds ratios and 95% confidence intervals (CIs) after controlling simultaneously for potential confounders. We used unintentional injury as the dependent variable. We included 15 significant risk factors in the analysis (family type, age of parents, education of parents, number of children, presence of infant or older siblings, living with grandparent, parents' employment status, use of sitter, kindergarten, or nursery school, type of housing, and annual income). All statistical tests were two-sided. A p-value less than 0.05 was considered statistically significant. Data analysis was performed using SPSS, version 23.0 (IBM Corporation, Armonk, NY, USA).

**Patient and Public Involvement**

The participants in this web-based questionnaire survey were selected from a database of candidates compiled by a private Japanese company specializing in questionnaire-based research. Returning the questionnaire was taken as agreement to participate in the study and informed consent was obtained from all participants.

## RESULTS

**Characteristics of the study population**

Of the 1000 households that participated in this study, 24 families were excluded because of missing data regarding the parents' education (n=2); type of housing (n=17); and primary caregivers apart from parents, grandparents, kindergarten teachers, and nursery school teachers during the daytime (n=5). Table 1 shows the basic characteristics of the 976 households that were included

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

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 |

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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 |

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

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

differences in incident rates of unintentional injuries across all groups. Table 4 shows the association between socioeconomic factors and timing of injury. Table 5 shows the association between socioeconomic factors and management after injury. Consistent with the main results, there was no relationship between socioeconomic factors and the variables in these tables.

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

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

| Factors | Overall (n=976) | Unintentional injury | | | | | | | | p-value† |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Fall (n=117) | Burn (n=47) | Poisoning/ Aspiration (n=12) | Drowning (n=6) | Traffic injury (n=7) | Others (n=12) | Total (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 | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Business technical school or junior college | 351 | 48 | 22 | 3 | 1 | 4 | 4 | 82 | 23.4 | |
| College | 348 | 36 | 10 | 7 | 3 | 1 | 4 | 61 | 17.5 | |
| Education of father | | | | | | | | | | p=0.200 |
| High school | 281 | 39 | 20 | 3 | 1 | 3 | 2 | 68 | 24.2 | |
| Business technical school or junior college | 150 | 20 | 6 | 2 | 0 | 0 | 2 | 30 | 20.0 | |
| College | 545 | 58 | 21 | 7 | 5 | 4 | 8 | 103 | 18.9 | |
| Number of children | | | | | | | | | | p=0.138 |
| 1 | 375 | 44 | 11 | 3 | 2 | 1 | 4 | 65 | 17.3 | |
| 2 | 447 | 53 | 26 | 7 | 4 | 4 | 7 | 101 | 22.6 | |
| ≥3 | 154 | 20 | 10 | 2 | 0 | 2 | 1 | 35 | 22.7 | |
| Infant (<1 year old) | | | | | | | | | | p=0.403 |
| Yes | 170 | 19 | 6 | 3 | 2 | 0 | 1 | 31 | 18.2 | |
| No | 806 | 98 | 41 | 9 | 4 | 7 | 11 | 170 | 21.1 | |
| Older siblings (>6 years old) | | | | | | | | | | p=0.330 |
| Yes | 374 | 47 | 22 | 5 | 1 | 4 | 4 | 83 | 22.2 | |
| No | 602 | 70 | 25 | 7 | 5 | 3 | 8 | 118 | 19.6 | |

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

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

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

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

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 | | | |
|---|---|---|---|---|---|
| | | Visit hospital (n=112) | Observation at home (n=88) | others (n=1) | Total (n=201) |
| Family type | | | | | |
| Two parents | 936 | 109 | 85 | 1 | 195 |

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

| | | | | | |
|---|---|---|---|---|---|
| Living with grandfather | | | | | |
| Yes | 362 | 44 | 35 | 0 | 79 |
| No | 614 | 68 | 53 | 1 | 122 |
| Mother's employment status | | | | | |
| Employed | 391 | 53 | 31 | 0 | 84 |
| Unemployed | 585 | 59 | 57 | 1 | 117 |
| Father's employment status | | | | | |
| Employed | 964 | 110 | 87 | 1 | 198 |
| Unemployed | 12 | 2 | 1 | 0 | 3 |
| Use of sitter, kindergarten, or nursery school | | | | | |
| Yes | 197 | 32 | 16 | 0 | 48 |
| No | 779 | 80 | 72 | 1 | 153 |
| Type of housing | | | | | |
| House | 516 | 73 | 37 | 0 | 110 |
| Apartment | 460 | 39 | 51 | 1 | 91 |
| Annual income (Yen) | | | | | |
| <3 million | 117 | 14 | 11 | 0 | 25 |
| 3–5 million | 366 | 36 | 41 | 1 | 78 |
| >5 million | 493 | 62 | 36 | 0 | 98 |

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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 |

## DISCUSSION

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

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

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

to a low social class than for those belonging to other social classes.[21] Alternatively, caregiver supervision might modify the association between unintentional injury and socioeconomic factors in younger ages, because the proportion of injuries witnessed by caregivers was high in our study. A previous study suggested lack of supervision made children under 5 years at risk of high mortality by unintentional injuries.[22] Therefore, the age of the children, which was under 6 years old in our study, might help to decrease the risk of unintentional injuries in lower socioeconomic classes. Second, the following characteristics specific to Japan might reduce the socioeconomic differences: relatively low exposure to environmental hazards, the social support network, and ethnic homogeneity.[23] The absolute number of traffic accidents in Japan has gradually decreased from 887000 in 2006 to 499000 in 2016, owing to new road traffic laws and improvements in the quality of roads, vehicle engineering, and driver behavior.[24 25] The Japanese government provides households with children's allowances according to income, employment, or financial support for single parent families, and visits for all families with infants.[26] All municipalities in Japan conduct health checkups at healthcare centers for children aged 18–23 months and children aged 36–47 months, despite socioeconomic differences. The mean response rate for these health checkups is over 90%.[27]

Taken together, our data and those from previous studies, confirm that the relationship between unintentional injury and socioeconomic factors differs for each nation.[7 8 10 11] It is difficult to generalize the influence of socioeconomic factors on the risk of unintentional childhood injuries. Therefore, prevention strategies should vary from country to country. In Japan, prevention strategies that focus on socioeconomic disadvantages would be inadequate. A comprehensive approach that involves health checkups could be a useful method

for prevention of unintentional injuries.

**Limitations**

This study had several limitations. First, only those households that had access to the internet were included. However, we selected households with a population distribution similar to that in the national census. We had a high internet penetration rate of the general population (83.5%) in Japan.[28] In addition, there were no differences between the relative poverty rates recorded in our study and those for the whole nation. Second, the outcome measures were based on self-reporting. The respondents may have been unaware of incidences of unintentional injury, or recalled the accident inaccurately. Thus, the incidence of unintentional injury might be underestimated. However, the incident rates recorded in our study are not very different from those obtained in other studies. Third, although we excluded households which had missing information regarding parent education and type of housing, this might have resulted in bias due to missing data. However, we excluded only 24 households. Additionally, the risk of unintentional injury was similar, despite of the high proportion of single parents in the missing data. Thus, it might not impact the validity of the conclusion. Finally, our inferences might be confounded by unmeasured factors, such as gender,

mental health conditions, and physical disability of the children. Future studies should measure the non-socioeconomic factors relating to unintentional injuries among children more explicitly.

**Conclusion**

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

## CONTRIBUTORSHIP STATEMENT

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

## COMPETING INTERESTS

None declared.

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## DATA SHARING STATEMENT

The database set was available for all authors of the study, and will be available for other non-commercial researchers on request.

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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*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up<br>*Case-control study*—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<br>*Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants | P5 |
| | | (*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed<br>*Case-control study*—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*) *Cohort study*—If applicable, explain how loss to follow-up was addressed<br>*Case-control study*—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) *Cohort study*—Summarise follow-up time (eg, average and total amount) | |
| Outcome data | 15* | *Cohort study*—Report numbers of outcome events or summary measures over time | |
| | | *Case-control study*—Report numbers in each exposure category, or summary measures of exposure | |
| | | *Cross-sectional study*—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.

**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.

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



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| | |

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

Nobuhiro Sato[a)], Yusuke Hagiwara[b)], Junta Ishikawa[a)], and Kohei Akazawa[a)]

[a] Department of Medical Informatics and Statistics, Niigata University Graduate School of Medicine, Niigata, Japan

[b] Department of Pediatric Emergency and Critical Care Medicine, Tokyo Metropolitan Children's Medical Center, Fuchu, Tokyo, Japan

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

**Word count:** 2096

## ABSTRACT

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

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

**Setting:** Japan (January 2015).

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

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

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

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

**Keywords:** Epidemiology, Pediatrics, Risk Factor Research, Socioeconomic Status

## 'Strengths and limitations of this study'

A nationwide questionnaire survey administered in Japan.

1000 households with a population distribution similar to that in the national census were included.

Confounders by unmeasured factors, such as physical disabilities in children, are study limitations.

## 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, 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.

The purpose of this study was to evaluate the influence of socioeconomic factors on the risk for unintentional injuries among children in Japan via a nationwide questionnaire survey.

## METHODS

### Study design and participants

This study involved a web-based questionnaire survey. The participants were selected in January 2015 from a database of 1,370,000 candidates compiled by a private Japanese company specializing in questionnaire-based research. We extracted data for 1000 households with preschool children under 6 years of age. All participants lived in Japan. Region was used as a variable for stratified random sampling. Hence, the region-wise distribution of our sample was almost identical to that of the general population in Japan. All respondents completed the questionnaire on a website developed specially for this study by the survey company. Exclusion criteria included not living with parents; missing information regarding parent education and type of housing; and children being cared for by people other than the parents, grandparents, kindergarten teachers, and nursery teachers during the daytime. An urban area was defined as an area with >15 million residents. Returning the questionnaire was taken as agreement to participate in the study and informed consent was obtained from all participants. This study was approved by the institutional ethics review board of Niigata City General Hospital.

### Measures

The questionnaire included 20 questions about basic and socioeconomic characteristics and 17 questions concerning unintentional injuries. The following

socioeconomic factors were used for evaluation: father's age; mother's age; living area; number of siblings; highest education levels of parents; annual income of parents; type of housing; parents' employment status; living with grandparents; primary caregiver during the daytime and at night; use of a sitter, kindergarten, or nursery school; and history of injuries. Parents were divided into three groups according to the mean age of mothers (30.7 years old) at the birth of the first child in Japan: ≤29 years, 30–39 years, ≥40 years.[15] Highest education level was classified as junior high school or high school, business technical school or junior college, and college. Annual income was classified as <3 million yen, 3–5 million yen, ≥5 million yen, based on the average income in Japan (median 4.28 million yen).[17] Type of housing was divided into house and apartment house categories. Injury was defined as physical damage that was fatal or caused aftereffects. We included the following types of injuries: all injuries, such as falls from stairs or a balcony; burns from hot liquids, hot surfaces, or fire; accidental poisoning; foreign body aspiration or suffocation; drowning; and traffic injuries.[10] The information collected about unintentional injuries included gender of child, time, place of injury, witnessed by others or not, and management after injury. The injury mechanism was defined as the injury that the respondent considered to be the most severe when the child experienced multiple unintentional injuries.

**Statistical Analysis**

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

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

chi-squared test or Fisher's exact test was used to explore the significance of differences between households reporting unintentional injuries and those that did not report any injuries.

Multiple logistic regression analysis was used to estimate the odds ratios and 95% confidence intervals (CIs) after controlling simultaneously for potential confounders. We used unintentional injury as the dependent variable. We included 15 significant risk factors in the analysis (family type, age of parents, education of parents, number of children, presence of infant or older siblings, living with grandparent, parents' employment status, use of sitter, kindergarten, or nursery school, type of housing, and annual income). All statistical tests were two-sided. A p-value less than 0.05 was considered statistically significant. Data analysis was performed using SPSS, version 23.0 (IBM Corporation, Armonk, NY, USA).

**Patient and Public Involvement**

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

## RESULTS

### Characteristics of the study population

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

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 |

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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 |

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

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

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

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

| Factors | Overall (n=976) | Unintentional injury | | | | | | | | | | | | | | p-value |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Fall (n=117) | %※ | Burn (n=47) | %※ | Poisoning/ Aspiration (n=12) | %※ | Drowning (n=6) | %※ | Traffic injury (n=7) | %※ | Others (n=12) | %※ | Total (n=201) | %※ | |
| Family type | | | | | | | | | | | | | | | | p=0.372 |
| Two parents | 936 | 112 | 12.0 | 47 | 5.0 | 12 | 1.3 | 6 | 0.6 | 6 | 0.6 | 12 | 1.3 | 195 | 20.8 | |
| Single parent | 40 | 5 | 12.5 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 1 | 2.5 | 0 | 0.0 | 6 | 15.0 | |
| 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 |

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

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

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 |

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

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 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Infant (<1 year old) | | | | | | | | | |
| Yes | 170 | 13 | 7.6 | 18 | 10.6 | 0 | 0.0 | 31 | 18.2 |
| No | 806 | 99 | 12.3 | 70 | 8.7 | 1 | 0.1 | 170 | 21.1 |
| Older siblings (>6 years old) | | | | | | | | | |
| Yes | 374 | 55 | 14.7 | 28 | 7.5 | 0 | 0.0 | 83 | 22.2 |
| No | 602 | 57 | 9.5 | 60 | 10.0 | 1 | 0.2 | 118 | 19.6 |
| Living with grandmother | | | | | | | | | |
| Yes | 128 | 13 | 10.2 | 13 | 10.2 | 0 | 0.0 | 26 | 20.3 |
| No | 848 | 99 | 11.7 | 75 | 8.8 | 1 | 0.1 | 175 | 20.6 |
| Living with grandfather | | | | | | | | | |
| Yes | 362 | 44 | 12.2 | 35 | 9.7 | 0 | 0.0 | 79 | 21.8 |
| No | 614 | 68 | 11.1 | 53 | 8.6 | 1 | 0.2 | 122 | 19.9 |
| Mother's employment status | | | | | | | | | |
| Employed | 391 | 53 | 13.6 | 31 | 7.9 | 0 | 0.0 | 84 | 21.5 |
| Unemployed | 585 | 59 | 10.1 | 57 | 9.7 | 1 | 0.2 | 117 | 20.0 |
| Father's employment status | | | | | | | | | |
| Employed | 964 | 110 | 11.4 | 87 | 9.0 | 1 | 0.1 | 198 | 20.5 |
| Unemployed | 12 | 2 | 16.7 | 1 | 8.3 | 0 | 0.0 | 3 | 25.0 |
| Use of sitter, kindergarten, or nursery school | | | | | | | | | |
| Yes | 197 | 32 | 16.2 | 16 | 8.1 | 0 | 0.0 | 48 | 24.4 |
| No | 779 | 80 | 10.3 | 72 | 9.2 | 1 | 0.1 | 153 | 19.6 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Type of housing | | | | | | | | | |
| House | 516 | 73 | 14.1 | 37 | 7.2 | 0 | 0.0 | 110 | 21.3 |
| Apartment | 460 | 39 | 8.5 | 51 | 11.1 | 1 | 0.2 | 91 | 19.8 |
| Annual income | | | | | | | | | |
| <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 |

※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 |

| | | | |
|---|---|---|---|
| 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 |

CI, confidence interval

## DISCUSSION

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

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

Nevertheless, our results differ from the outcomes reported in other studies of the relationship between unintentional injuries and socioeconomic factors.[7 10 12] There are several explanations for these results. First, the younger age of children may affect the relationship between the risk for unintentional injuries and socioeconomic factors. A previous study showed very minor socioeconomic differences in the injury risk among 0–4-year-old children in Sweden.[20] However, socioeconomic differences were observed for traffic injury risk from the age of 5 years onwards.[20] Another study reported that the relative risk of being injured in a road traffic incident is higher for 5–19-year-olds with low socioeconomic status than for those with higher socioeconomic status.[21] Alternatively, caregiver supervision might modify the association between unintentional injury and socioeconomic factors in younger ages, because the proportion of injuries witnessed by caregivers was high in our study. A previous study suggested lack of supervision made children under 5 years at risk of high mortality by unintentional injuries.[22] Therefore, the age of the children, which was under 6 years old in our study, might help to decrease the risk of unintentional injuries in lower socioeconomic status families. Second, the following characteristics specific to Japan might reduce the socioeconomic differences: relatively low exposure to environmental hazards, the social support network, and ethnic homogeneity.[23] The absolute number of traffic accidents in Japan has gradually decreased from 887000 in 2006 to 499000 in 2016, owing to new road traffic laws and improvements in the quality of roads, vehicle engineering, and driver behavior.[24 25] The Japanese government provides households with children allowances according to income, employment or financial support for single parent families, and visits for all families with infants.[26] All municipalities in Japan conduct health checkups at healthcare centers for children aged 18–23 months and

children aged 36–47 months, despite socioeconomic differences. The mean response rate for these health checkups is over 90%.[27]

Taken together, our data and those from previous studies, confirm that the relationship between unintentional injury and socioeconomic factors differs for each nation.[6-8 10 11 13 28 29] It is difficult to generalize the influence of socioeconomic factors on the risk of unintentional childhood injuries. Therefore, prevention strategies should vary from country to country. In Japan, prevention strategies that focus on socioeconomic disadvantages would be inadequate. A comprehensive approach that involves health checkups could be a useful method for prevention of unintentional injuries.

**Limitations**

This study had several limitations. First, only those households that had access to the internet were included. However, we selected households with a population distribution similar to that in the national census. We had a high internet penetration rate of the general population (83.5%) in Japan.[30] In addition, there were no differences between the relative poverty rates recorded in our study and those for the whole nation. Second, the outcome measures were based on self-reporting. The respondents may have been unaware of incidences of unintentional injury, or recalled the accident inaccurately. Thus, the incidence of unintentional injury might be underestimated. However, the incident rates recorded in our study are not very different from those obtained in other studies. Third, although we excluded households which had missing information regarding parent education and type of housing, this might have resulted in bias due to missing data. However, we excluded only 24 households. Additionally, the risk of unintentional injury was similar, despite of the high proportion of single parents in

the missing data. Thus, it might not impact the validity of the conclusion. Finally, our inferences might be confounded by unmeasured factors, such as gender, mental health conditions, and physical disability of the children. Future studies should measure the non-socioeconomic factors relating to unintentional injuries among children more explicitly.

**Conclusion**

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

## CONTRIBUTORSHIP STATEMENT

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

## COMPETING INTERESTS

None declared.

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## DATA SHARING STATEMENT

The database set was available for all authors of the study, and will be available for other non-commercial researchers on request.

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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*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up<br>*Case-control study*—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<br>*Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants | P5 |
| | | (*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed<br>*Case-control study*—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*) *Cohort study*—If applicable, explain how loss to follow-up was addressed<br>*Case-control study*—If applicable, explain how matching of cases and controls was addressed<br>*Cross-sectional study*—If applicable, describe analytical methods taking account of sampling strategy | P5 |

| | | | |
|---|---|---|---|
| | | (*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) *Cohort study*—Summarise follow-up time (eg, average and total amount) | |
| Outcome data | 15* | *Cohort study*—Report numbers of outcome events or summary measures over time | |
| | | *Case-control study*—Report numbers in each exposure category, or summary measures of exposure | |
| | | *Cross-sectional study*—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.

**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.