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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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## ABSTRACT

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

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

**Setting** Japan (January 2015).

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

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

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

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

## 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 (behaviours 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 Organisation for Economic Cooperation and Development 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 specialising in questionnaire-based research. We extracted data for 1000 households with preschool children under 6 years of age. All participants lived in Japan. Region was used as a variable for stratified random sampling. Hence, the region-wise distribution of our sample was almost identical to that of the general population in Japan. All respondents completed the questionnaire on a website developed specially for this study by the survey company. Exclusion criteria included

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

### Measures

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

**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 |

**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 |
| Night-time 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 |

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

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

Continued

**Table 3** Continued

| 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) | %* | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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 $\chi^2$ test or Fisher's exact test for total number of unintentional injuries.

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

| Factors | Overall (n=976) | Unintentional injury | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Daytime on a weekday (n=106) | %* | Night-time 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 |

Continued

**Table 4** Continued

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

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

technical school or junior college and college. Annual income was classified as <3 million yen, 3–5 million yen and ≥5 million yen, based on the average income in Japan (median 4.28 million yen).[17] Type of housing was divided into house and apartment house categories. Injury was defined as physical damage that was fatal or caused after-effects. We included the following types of injuries: all injuries, such as falls from stairs or a balcony; burns from hot liquids, hot surfaces or fire; accidental poisoning; foreign body aspiration or suffocation; drowning; and traffic injuries.[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 IQRs, and categorical data as proportions. The Pearson's $\chi^2$ test or Fisher's exact test was used to explore the significance of differences between households reporting unintentional injuries and those that did not report any injuries.

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

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

### Patient and public involvement

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

### RESULTS

### Characteristics of the study population

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

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

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

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

| | | Unintentional injury | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Factors | Overall (n=976) | 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 |

Continued

**Table 5** Continued

| | | Unintentional injury | | | | | | | |
| Factors | Overall (n=976) | Visit hospital (n=112) | %* | Observation at home (n=88) | %* | Others (n=1) | %* | Total (n=201) | %* |
|---|---|---|---|---|---|---|---|---|---|
| Use of sitter, kindergarten or nursery school | | | | | | | | | |
| Yes | 197 | 32 | 16.2 | 16 | 8.1 | 0 | 0.0 | 48 | 24.4 |
| No | 779 | 80 | 10.3 | 72 | 9.2 | 1 | 0.1 | 153 | 19.6 |
| Type of housing | | | | | | | | | |
| House | 516 | 73 | 14.1 | 37 | 7.2 | 0 | 0.0 | 110 | 21.3 |
| Apartment | 460 | 39 | 8.5 | 51 | 11.1 | 1 | 0.2 | 91 | 19.8 |
| Annual income | | | | | | | | | |
| <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.

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

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

## DISCUSSION

Herein, we observed that unintentional injuries among preschool children under 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 organisation.[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 887 000 in 2006 to 499 000 in 2016, owing to new road traffic laws and improvements in the quality of roads, vehicle engineering and driver behaviour.[24 25] The Japanese government provides households with children allowances according to income, employment or financial

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

support for single parent families, and visits for all families with infants.[26] All municipalities in Japan conduct health checkups at healthcare centres for children aged 18–23 months and children aged 36–47 months, despite socioeconomic differences. The mean response rate for these health checkups is over 90%.[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 generalise the influence of socioeconomic factors on the risk of unintentional

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

## Limitations

This study had several limitations. First, only those households that had access to the internet were included. However, we selected households with a population distribution similar to that in the national census. We had a high internet penetration rate of the general population (83.5%) in Japan.[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.

**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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