Parental Internet Use and Lifestyle Factors as Correlates of Prolonged Screen Time of Children in Japan: Results From the Super Shokuiku School Project

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ABSTRACT

Background: Prolonged screen time (ST), which includes TV viewing and gaming on smartphones and computers, is linked to poor health. Our aim was to explore the associations between school children with prolonged ST and parental internet use (IU) and lifestyles in Japan.

Methods: Children aged 6 to 13 years from the Super Shokuiku School Project, were surveyed using questionnaires in 2016. The survey assessed the grade, sex, and lifestyle of 1,659 children and parental internet use (IU) and lifestyle using Breslow’s seven health behaviors. IU consisted of internet surfing and gaming on personal computers (PC), smartphones, or consoles. Three or more hours of ST was defined as prolonged ST, and its correlates were analyzed using logistic regression.

Results: Of all, 643 (38.8%) children spent ≥2 hours/day of ST on a week day, whilst 153 (9.2%) children spent ≥3 hours/day. Prolonged ST was significantly associated with children in higher grade (odds ratio [OR] 1.74; 95% confidence interval [CI], 1.20–2.51), boys (OR 2.16; 95% CI, 1.49–3.14), skipping breakfast (OR 1.88; 95% CI, 1.05–3.35), late bedtime (OR 1.80; 95% CI, 1.15–2.82), physical inactivity (OR 1.79; 95% CI, 1.12–2.87), father’s IU ≥2 hours/day (OR 2.35; 95% CI, 1.52–3.63), mother’s prolonged IU ≥2 hours/day (OR 2.55; 95% CI, 1.43–4.52), mothers with unhealthy behaviors (OR 1.81; 95% CI, 1.05–3.13), no rule setting governing screen time (OR 2.41; 95% CI, 1.63–3.58), and mothers with full-time employment (OR 1.95; 95% CI, 1.06–3.64).

Conclusions: Prolonged ST among Japanese children was strongly associated with parental IU, no set rules for ST, and mother’s unhealthy lifestyles. To reduce children’s ST, parental engagement is warranted in the intervention strategy.

Key words: internet; screen time; parent; Super Shokuiku School Project; food education

INTRODUCTION

New information and communication technologies have become common for children and adults in Japan. A 2016 white paper from Japan’s Ministry of Internal Affairs and Communications indicated that the average time of TV viewing for Japanese adults was about 3 hours/day, and internet use was about 1.5 hours/day in 2015.1 While the length of time for viewing TV remains unchanged, that of internet use among adult has been increasing steadily (from 71.6 in 2012 to 90.4 minutes in 2015).1 Although the use of these media are becoming essential for children and adults, there have been a number of reports on the harmful effects of prolonged screen time (ST) in children,2 which includes viewing of videos and TV, gaming on consoles or smartphones, and internet use (IU). In 2004, The Japanese Pediatric Association proposed to parents that ST be reduced in all growing children to nurture wholesome family relationships.3

Prolonged ST in children has been associated with unfavorable health and social outcomes, such as obesity,4 physical inactivity,5 aggressive behaviors,7,8 and poor academic achievement.9 Given these health implications, understanding modifiable factors that contribute to reducing ST among children is essential. From previous research, children’s age, parent’s long hours of TV viewing, and no rule setting for ST at home have been found to be clearly associated with prolonged ST among children.10–12 Therefore, a relationship between parents and children was assessed, and family-based interventions were recommended, to decrease ST in children.13 However, many reports of ST correlates, which may lead to practical interventions, have not considered the relationship with the general lifestyle of the parents. Moreover, these studies have been conducted in western countries. Research about modifiable correlates of ST of children is insufficient in Japan.

The exponential growth in different types of screen technologies, and IU on smartphones or tablet PCs are increasingly being viewed as detrimental factors for children.3 To date, it is well known that parents’ lifestyles associate with those of their children and are crucial risk factors for their children’s health outcomes.14–16 An online survey by the Japanese government about IU in the youth reported that the average time
of parental IU was almost 2 hours/day, highlighting that 35.1% of all parents spent 2 or more hours daily on IU. However, the impact of parental IU on child health or behavior has not been fully surveyed. We hypothesized that parental IU, as well as general lifestyles, might have strong associations with prolonged ST in children. Given the rapid technological development, and increase in the time spent on the internet, more recent data are needed to determine modifiable correlates of prolonged ST.

The purpose of our study was to report children’s ST from a recent survey and to explore correlates of prolonged ST among elementary school children in Japan.

**METHODS**

Participants and the Super Shokuiku School Project

The Super Shokuiku School Project is a food education project which was supported by Japan’s Ministry of Education, Culture, Science and Technology (MEXT). The overall purposes of the project were to promote healthy lifestyles in school children and improve their health through food education, appreciation of food producers, and participation in farming events. The project was evaluated using repeated questionnaire surveys before and after food education. The baseline survey (Phase 1) was conducted before food education, in May 2014. The follow-up surveys were conducted after food education, in December 2014 (Phase 2) and January 2016 (Phase 3). We obtained detailed information on media use and parental lifestyle factors from phase 3 and conducted a cross-sectional study to assess family relationships and health behaviors. Participants were 2,129 children aged 6 to 13 years who belonged to 5 elementary schools in Takaoka city, Japan. Twenty children were excluded due to illiteracy in Japanese of their parents. A total of 1,987 children agreed to participate in our survey and returned the questionnaires (response rate: 94.2%). The survey was approved by the Ethics Committee of the University of Toyama. Written informed consent was obtained from the participants’ parents, and participation was voluntary.

**Questionnaire**

The children and their parents completed questionnaires and returned the questionnaires to their schools. The questionnaires for children queried information on sex, grade, food knowledge, total ST on a week day, other lifestyles, and self-rated health. Questionnaires for parents included assessment of their own lifestyles, time of IU at home on a weekday, perceived family affluence, and parents’ employment status.

**Children’s lifestyle and obesity**

Lifestyles (breakfast, physical activity, ST, rules that limit ST and other lifestyles, and self-rated health). Questionnaires for parents included assessment of their own lifestyles, time of IU at home on a weekday, perceived family affluence, and parents’ employment status.

**Statistical analysis**

Taking children’s grade (age) difference for lifestyles and ST into consideration, we divided children into two groups, lower (1–3)
and higher (4–6) grades, for descriptive data. Chi-squared test was performed to compare variables by groups. Then, to assess the between-school (cluster) variance in children’s ST, interclass correlation (ICC) was calculated with the six categories of ST defined as continuous variables. Finally, univariate and multivariate logistic regression analyses were conducted to evaluate the strength of the associations of the lifestyle of children and parents with prolonged ST, using the forced entry methods. Father’s employment status was excluded from the regression analysis because almost all the fathers were full-time workers (99.5%). The odds ratios (OR) and 95% confidence intervals (CI) were calculated. Analyses were conducted using the statistical package for social scientists (SPSS) version 22.0 J (SPSS, Chicago, IL, USA). A two-tailed P-value of less than 0.05 was considered statistically significant.

**RESULTS**

Out of 1,987 who returned their questionnaires, 1,659 school children (78.7%; 828 boys and 831 girls) who answered all the questionnaire items relevant to the present study were included in our analyses. About 40% of children (n = 643) spent ≥2 hr/day on ST, and 9.2% (n = 153) spent ≥3 hr/day. There was no significant difference in sex, obesity, parental IU, numbers of health behaviors, or perceived family influence between children in lower (1–3) and higher (4–6) grades. However, children in higher grades were more likely to skip breakfast, go to bed late, and have prolonged ST, while children in lower grades were more likely to be physically active and have unemployed mothers (Table 1). ICC in children’s ST was only 4.6%.

In Table 2, logistic regression analyses were performed to determine the strength of association of the lifestyle of children and parents with prolonged ST in children. For univariate analysis, children in higher grades (OR 1.98; 95% CI, 1.40–2.18), being a boy (OR 1.78; 95% CI, 1.27–2.51), skipping breakfast (OR 2.63; 95% CI, 1.58–4.37), late bed time (OR 2.45; 95% CI, 1.64–3.65), physical inactivity (OR 2.15; 95% CI, 1.39–3.33), both father’s and mother’s IU for ≥2 hr/day (OR 2.92; 95% CI, 2.00–4.26 for father’s and OR 4.39; 95% CI, 2.70–7.16 for mother’s), mothers with lower Breslow’s behaviors (OR 2.99; 95% CI, 1.87–4.80), no rule setting to limit ST at home (OR 2.64; 95% CI, 1.84–3.78), mothers with full-time employment status (OR

### Table 1. Characteristics of children by grade (n = 1,659)

|                        | Low (1st–3rd) n = 824 | High (4th–6th) n = 835 | P value |
|------------------------|------------------------|------------------------|---------|
| Age, years, mean (SD)  | 7.9 (0.87)             | 11.0 (0.85)            |         |
| Sex                    |                         |                        |         |
| Boy                    | 414 (50.2)              | 414 (49.5)             | 0.806   |
| Breakfast              |                         |                        |         |
| Skipping               | 36 (4.4)                | 71 (8.5)               | <0.001  |
| Bedtime, p.m.          |                         |                        |         |
| <10                    | 732 (88.8)              | 448 (53.7)             | <0.001  |
| 10≤ to <10:30          | 73 (8.9)                | 262 (31.3)             |         |
| ≥10:30                 | 19 (2.3)                | 125 (15.0)             |         |
| Physical activity      |                         |                        |         |
| Very often             | 233 (28.3)              | 238 (28.5)             | <0.001  |
| Often                  | 403 (48.9)              | 332 (39.7)             |         |
| Rarely or almost never | 188 (22.8)              | 265 (31.8)             |         |
| Obesity                |                         |                        |         |
| Obese                  | 67 (8.1)                | 64 (7.6)               | 0.715   |
| Father’s IU at home, h/day ≥2 | 123 (14.9)   | 116 (13.9)             | 0.576   |
| Mother’s IU at home, h/day ≥2 | 45 (5.5)     | 48 (5.8)               | 0.831   |
| Father’s health behaviors in Breslow’s High (6–7) | 196 (23.8) | 163 (19.5) | 0.080 |
| Middle (4–5)           | 337 (40.9)              | 375 (45.0)             |         |
| Low (0–3)              | 291 (35.5)              | 297 (35.5)             |         |
| Mother’s health behavior in Breslow’s High (6–7) | 235 (28.5) | 215 (25.7) | 0.129 |
| Middle (4–5)           | 445 (54.0)              | 458 (354.9)            |         |
| Low (0–3)              | 144 (17.5)              | 162 (19.4)             |         |
| Rule setting to restrict ST No | 137 (16.6)   | 161 (19.3)             | 0.160   |
| Father’s employment status Fulltime | 821 (99.6) | 829 (99.3) | — |
| Part time              | 1 (0.1)                 | 2 (0.2)                |         |
| Unemployed             | 2 (0.2)                 | 4 (0.5)                |         |
| Mother’s employment status Fulltime | 326 (39.6) | 344 (41.2) | 0.010 |
| Part time              | 355 (43.1)              | 389 (46.6)             |         |
| Unemployed             | 143 (17.4)              | 102 (12.1)             |         |
| Perceived Family Affluence Affluent | 233 (28.3) | 224 (26.9) | 0.793 |
| Neither                | 391 (47.5)              | 400 (48.0)             |         |
| No affluent            | 200 (24.3)              | 211 (25.2)             |         |
| Children’s ST, h/day   |                         |                        |         |
| <2                    | 542 (65.8)              | 474 (56.8)             | <0.001  |
| 2≤ to <3              | 229 (27.8)              | 261 (31.2)             |         |
| ≥3                    | 53 (6.4)                | 100 (12.0)             |         |

IU, Internet use; ST, screen time.
P values in Pearson’s chi-square test were shown.
Logistic regression analysis on children’s prolonged ST (n = 1,659)

|                          | ST >3h/day or more (%) | Univariate OR 95% CI | Multivariate OR 95% CI |
|--------------------------|------------------------|----------------------|-----------------------|
| Grade                    | High (4-6th) (/Low)    | 12.0/6.4             | 1.98*** 1.40–2.81      | 1.74** 1.26–2.51          |
| Sex                      | Boy (∕Girl)            | 11.4/6.9             | 1.78*** 1.27–2.51      | 2.16** 1.49–3.14          |
| Breakfast                | Skipping (/No Skip)    | 19.6/8.5             | 2.63*** 1.58–4.37      | 1.88* 1.05–3.35           |
| Bedtime, p.m.            | Later bed time         | 17.5/8.0             | 2.45*** 1.64–3.65      | 1.80** 1.15–2.82           |
|                          | (/Low grader for <10,  High grader for <10:30) |                        |                       |
| Physical activity        | Very often             | 7.2                  | 1                     | 1                    |
|                          | Often                  | 7.4                  | 1.02 0.65–1.59         | 0.94 0.59–1.50          |
|                          | Rarely or almost never | 14.3                 | 2.15*** 1.39–3.33      | 1.79** 1.12–2.87          |
| Obesity                  | Obese (/Non-Obese)     | 13.1/8.9             | 1.54 0.90–2.64         | 1.32 0.72–2.42           |
| Father’s IU at home, h/day | ≥2 (/≤2)               | 19.2/7.5             | 2.92*** 2.00–4.26      | 2.35** 1.52–3.63          |
| Mother’s IU at home, h/day | ≥2 (/≤2)               | 28.0/8.1             | 4.39*** 2.70–7.16      | 2.55*** 1.43–4.52         |
| Father’s health behaviors in Breslow’s | High (6–7)    | 8.4                  | 1                     | 1                    |
|                          | Middle (4–5)           | 7.6                  | 0.90 0.57–1.43         | 0.77 0.47–1.28          |
|                          | Low (0–3)              | 11.8                 | 1.46 0.93–2.29         | 0.94 0.56–1.59          |
| Mother’s health behavior in Breslow’s | High (6–7)    | 6.7                  | 1                     | 1                    |
|                          | Middle (4–5)           | 7.6                  | 1.16 0.74–1.80         | 0.90 0.55–1.45          |
|                          | Low (0–3)              | 17.6                 | 2.99*** 1.87–4.80      | 1.81† 1.05–3.13          |
| Rule setting to restrict ST | No (/Yes)              | 17.4/7.4             | 2.64*** 1.84–3.78      | 2.41*** 1.63–3.58         |
| Mother’s employment status | Full time              | 10.9                 | 1.87* 1.05–3.32        | 1.96 1.06–3.64          |
|                          | Part time              | 8.7                  | 1.46 0.82–2.61         | 1.47 0.79–2.75          |
|                          | Unemployed             | 6.1                  | 1                     | 1                    |
| Perceived Family Affluence | Affluent               | 7.2                  | 1                     | 1                    |
|                          | Neither                | 9.4                  | 1.33 0.87–2.03         | 1.08 0.68–1.71          |
|                          | No affluent             | 11.2                 | 1.62* 1.02–2.59        | 1.07 0.64–1.79          |

CI, confidence interval; IU, internet use; OR, odds ratio; ST, screen time.

* P < 0.05, ** P < 0.01, *** P < 0.001.

1.87; 95% CI, 1.05–3.32), and no family affluence (OR 1.62; 95% CI, 1.02–2.59) were associated with prolonged ST in children. In multivariate analysis, children in higher grades (OR 1.74; 95% CI, 1.20–2.51), being a boy, (OR 2.16; 95% CI, 1.49–3.14), skipping breakfast (OR 1.88; 95% CI, 1.05–3.35), late bed time (OR 1.80; 95% CI, 1.15–2.82), physical inactivity (OR 1.79; 95% CI, 1.12–2.87), both father’s and mother’s IU for ≥2 hr/day (OR 2.35; 95% CI, 1.52–3.63 for father’s and OR 2.55; 95% CI, 1.43–4.52 for mother’s), mothers with low Breslow’s behaviors (OR 1.81; 95% CI, 1.05–3.13), no rule setting to limit ST at home (OR 2.41; 95% CI, 1.63–3.58), and mother with full-time employment status (OR 1.96; 95% CI, 1.06–3.64) were significantly associated with prolonged ST. The association between family affluence and prolonged ST seen in univariate analysis was not observed in the multivariate analysis.

Table 3 shows the association between parental IU and each health behavior, and children’s prolonged ST. Improper weight control, no regular exercise and frequent snacking were behaviors of the fathers found to be associated with prolonged ST in univariate analysis, however, these associations were not observed in the multivariate analysis. On the other hand, mother’s behaviors, except frequent snacking, were associated with prolonged ST in the univariate analysis, whilst the significant associations of inadequate sleep (OR 1.45; 95% CI, 1.01–2.07) and excessive drinking (OR 2.30; 95% CI, 1.32–4.01) was observed in the multivariate analysis. Both parental IU were strongly associated with children’s prolonged ST (OR 1.22; 95% CI, 0.79–1.90 for 1 to <2 hr/day and OR 2.29; 95% CI, 1.45–3.60 for ≥2 hr/day in father’s IU; OR 1.54; 95% CI, 0.99–2.38 for 1 to <2 hr/day and OR 3.51; 95% CI, 1.99–6.20 for ≥2 hr/day in mother’s IU).

DISCUSSION

Our results showed that about 10% of children spent 3 or more hours of total ST on a weekday, which was less prevalent than in the national survey reporting that 34.0% of children spent 3 or more hours on TV and DVD viewing, and that parental IU and rule setting at home were strongly associated with children’s ST. These associations were stronger than that of children’s sex, age, and lifestyle. Moreover, we observed an association between mother’s lifestyle and children’s ST. These findings could help health practitioners and media researchers who work with children to understand modifiable factors that contribute to reducing ST among children.

Internet use

Previous literature has shown a significant relationship between screen-based behaviors of both parents and children, much of which focused mainly on TV viewing. We used parental IU instead of TV viewing because of the following three reasons: First, IU requires much more attention of users than TV viewing, and that parental IU and TV Viewing are not viewed as equivalent behaviors. Second, the 2016 white paper from Japan’s Ministry of Internal Affairs and Communications reported that the average time of TV viewing among those aged in their 30s was decreasing year by year, while their average time spent on IU was steadily increasing.
especially thought to be a detrimental factor in Japan. Size is usually smaller than that of TV. Moreover, parental IU is and communicate with other family members because the screen reports, such as 60.9% in the United States,27 36.1% in the Czech Republic and Slovakia,12 and about 50% in China.11 Japanese society,3 where multiple devices for IU, including the smart phone, have become dramatically more common in recent years. Nowadays, 83.0% of Japanese are reported to connect to the internet.1 For these reasons, we hypothesized that parental IU was 9.7% in 2002, a rate which soared up to 72.0% in 2015. This corresponds with other research.10-12,28 We found that the majority of children (82.0%) had a rule with their parents to restrict total ST. This percentage was higher than other previous reports, such as 60.9% in the United States,27 36.1% in the Czech Republic and Slovakia,12 and about 50% in China.11 Japanese health practitioners should continuously recommend more families to apply this kind of restriction at home.

Rule setting
In our study, an existence of rule to limit children’s ST was found to be significantly associated with fewer reports of prolonged ST. This corresponds with other research.10-12,28 We found that the majority of children (82.0%) had a rule with their parents to restrict total ST. This percentage was higher than other previous reports, such as 60.9% in the United States,27 36.1% in the Czech Republic and Slovakia,12 and about 50% in China.11 Japanese

Table 3. Associations of parental IU and lifestyles with children’s prolonged ST (n = 1,659)

|                          | ST 3 h/day or more (%) | univariate OR (95% CI) | multivariate OR (95% CI) |
|--------------------------|------------------------|------------------------|--------------------------|
| Father’s IU at home, h/day | <1                     | 6.7                    | 1                        | 1                        |
|                          | 1 ~ <2                 | 9.6                    | 1.48                     | 0.98–2.24                | 1.22                     | 0.79–1.90 |
|                          | ≥2                     | 19.2                   | 3.32***                  | 2.21–4.97                | 2.29***                  | 1.45–3.60 |
| Mother’s IU at home, h/day | <1                     | 6.9                    | 1                        | 1                        |
|                          | 1 ~ <2                 | 13.1                   | 2.02**                   | 1.35–3.01                | 1.54                     | 0.99–2.38 |
|                          | ≥2                     | 28.0                   | 5.12***                  | 3.15–8.59                | 3.51***                  | 1.99–6.20 |
| Father’s health behaviors in Breslow’s (not good/good behavior) | Adequate sleep (no/yes) | 9.1/9.3                | 0.98                     | 0.70–1.37                | 0.75                     | 0.52–1.08 |
|                          | Smoking (yes/no)       | 10.8/8.0               | 1.39                     | 0.99–1.94                | 1.16                     | 0.80–1.69 |
|                          | Proper weight control (no/yes) | 11.2/8.0       | 1.46*                    | 1.04–2.04                | 1.07                     | 0.74–1.54 |
|                          | Excessive drinking (yes/no) | 10.7/8.8               | 1.24                     | 0.85–1.82                | 0.94                     | 0.62–1.42 |
|                          | Regular exercise (no/yes) | 10.3/6.9               | 1.56*                    | 1.06–2.30                | 1.35                     | 0.82–2.05 |
|                          | Skipping breakfast (yes/no) | 10.8/8.6               | 1.27                     | 0.89–1.83                | 0.96                     | 0.64–1.43 |
|                          | Snacking often (yes/no) | 11.2/7.9               | 1.48*                    | 1.06–2.07                | 1.02                     | 0.70–1.50 |
| Mother’s health behaviors in Breslow’s (not good/good behavior) | Adequate sleep (no/yes) | 11.5/7.4               | 1.62**                   | 1.16–2.27                | 1.45*                    | 1.01–2.07 |
|                          | Smoking (yes/no)       | 15.4/8.4               | 1.98**                   | 1.27–3.08                | 1.41                     | 0.84–2.35 |
|                          | Proper weight control (no/yes) | 12.3/7.9           | 1.65*                    | 1.17–2.32                | 1.04                     | 0.71–1.52 |
|                          | Excessive drinking (yes/no) | 20.4/8.4               | 2.78***                  | 1.66–4.63                | 2.30**                   | 1.32–4.01 |
|                          | Regular exercise (no/yes) | 10.1/5.9               | 1.79*                    | 1.11–2.89                | 1.57                     | 0.96–2.55 |
|                          | Skipping breakfast (yes/no) | 13.5/8.5               | 1.72*                    | 1.12–2.64                | 1.17                     | 0.72–1.89 |
|                          | Snacking often (yes/no) | 9.8/8.5                | 1.17                     | 0.84–1.64                | 0.92                     | 0.64–1.32 |

CI, confidence interval; IU, internet use; OR, odds ratio; ST, screen time.

*: P < 0.05, **: P < 0.01, ***: P < 0.001.

Mother’s employment status and perceived family affluent were adjusted in multivariate analysis.

Basic characteristics, lifestyle, and obesity
Other studies have shown that being a boy, an older age, physical inactivity, unhealthy dietary behaviors, sleep problems, and obesity were associated with prolonged ST in children.10,11,29-32 In line with these results, we found significant associations between prolonged ST and being a boy, children in higher grades, physical inactivity, skipping breakfast, and late bed time. Although several previous reports have shown obesity to be associated with ST,29,33 there was no significant relationship between prolonged ST and obesity in our study. This may be due to the much lower prevalence of obesity in our study (7.8%) compared with others; prevalence of obesity was 23.7% in Irish and 53.8% in Iranian children in other studies.34,35

Mother’s unhealthy lifestyle, which was assessed using the Breslow’s seven health-related behaviors, was associated with prolonged ST in children. From the specific analysis of parental lifestyle, children of mothers who did not have adequate sleep, smoked, drank excessively, and did not exercise regularly were more likely to have prolonged ST. On the other hand, father’s health behaviors were not associated with prolonged ST in children. Our results were in line with the previous literature from Sekine et al.15 They reported that children’s unhealthy lifestyles, such as skipping breakfast, inadequate physical activity, and prolonged TV viewing, were associated with mother’s obesity but not with father’s obesity. A plausible explanation about the difference may be that mothers have played a key role in rearing children in Japan. This is one of the few limited studies to clarify the relationship between parental lifestyle and children’s prolonged ST. It is important for health providers and guardians of children to consider mother’s lifestyle, as well as children’s own lifestyle, in the reduction of ST in children.
**SES and parental employment status**

The association between SES and ST in children remains unclear, although negative associations have been observed in developed countries (children in higher SES had less ST), while positive associations have been observed in developing countries. In our study, we found a significant relationship in the univariate analysis, which was not observed in the multivariate model. This difference may have resulted from the method of analyses. Previous researches, which were conducted in the United Kingdom and Australia, did not include parental and children’s lifestyle and media. Thus, these lacking factors may have a strong influence on children’s ST, rather than SES.

We also found a significant relationship with mother’s employment status. Compared to mothers who are unemployed or with part-time jobs, those with full-time employment were likely to let their children have long ST. Our results supported previous studies that showed association between unhealthy children’s lifestyle and mother’s longer work schedule. Magee et al showed that children of mothers working ≥45 hr/week had later bed time and higher OR of short sleep hours. Sekine et al pointed out that children of mothers working full-time were more likely to watch TV for longer hours, had frequent snacks, and went to bed late. In our study, children of mothers working part time did not show a significant increase in ST compared to children with unemployed mothers. Duration of hours of work of parents may influence children’s lifestyle. However, we cannot insist that mothers should work less in the current society in Japan, where a growing number of mothers are full-time workers. This may be impossible for many families and could have adverse influences, such as loss of income; however, what counts is to recognize the children’s lifestyle activity and lessen any negative effect on children, by providing playgrounds, daycare centers with physically active games, and tutoring from sufficient staff or health practitioners.

**Study strengths and limitations**

To the best of our knowledge, this is the first study to examine the strength of associations of prolonged ST in school children with their lifestyle, as well as parental IU and lifestyle, in Japan. We found that both parents IU and rule setting had stronger relationships with prolonged ST in children than children’s lifestyle did. Thus, interventions for reducing ST among children must involve parents as well as children. Guardians and childcare staff should be educated on the importance of limiting length of time of parental IU, and of rule setting in reducing ST in children.

Our study has some limitations. First, our study design was cross-sectional, so we were not able to infer causation. However, reverse causality, in which children’s prolonged ST led to longer parental IU, is unlikely. Limiting parental IU may be a plausible intervention for prolonged ST in children. Second, questionnaires could not reflect the actual lifestyle and anthropometry data. Children might report their lifestyles better than they actually led according to social expectation. This kind of bias could occur among parents as well. The national data conducted in 2014 reported that about 35% of parents of elementary school children spent 2 or more hours in IU a day. Our questionnaire might not reflect the actual time duration. Objective date will be needed in future study, especially about time, such as ST and IU. Third, our questionnaire asked only the total ST for children and IU for their parents. To focus on recreational use, time spent on studying for children or working for parents should have been divided. Fourth, our study did not include potential factors, such as number of TVs in a household, the existence of a TV, game or other media in child’s bedroom, parental TV viewing, and children’s characteristics, such as attentional abilities and self-regulation behaviors. Future studies are needed to test the association or effect of these factors. Finally, our research restricted the participants to dual-parent families to assess both parent’s IU and lifestyle. We could not explore single-parent families. Given our results, children of a single mother working longer may have longer ST than in a dual-parent family. Further studies that include single-parent families are also needed for child health promotion.

**Conclusions**

The present study provides data about correlates of prolonged ST among Japanese elementary school children. Parental IU and rule setting have stronger relationships with prolonged ST in children than children’s own lifestyle, such as skipping breakfast, late bedtime, and physical inactivity. In addition, mother’s unhealthy lifestyle correlates strongly with prolonged ST in children. In Japan, where the social trend of people owning and spending time on smartphones or tablet PC is increasing, health practitioners and guardians of children should be informed about these results. The engagement of parents in creating a healthier family environment is warranted as an intervention strategy for reducing ST in children.

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Author contribution: M.Y designed, distributed questionnaires, collected, analyzed the data, and wrote the manuscript. M.S supervised, designed, collected and consulted mainly with the Education Committee. M.S and T.T provided technical supports and conceptual advice. All authors read and approved the final manuscript.

**REFERENCES**

1. White Paper 2016. Information and Communication Japan. Ministry of Internal Affair and Communications Japan [updated 2016 Feb; Cited 2017 July 12]. Available from: http://www.soumu.go.jp/johotsusintokei/whitepaper/ ja/h28/html/nc252510.html (in Japanese).

2. Biddle SJ, Gorely T, Marshall SJ, Murdey I, Cameron N. Physical activity and sedentary behaviours in youth: issues and controversies. J R Soc Promot Health. 2004;124(1):29–33.

3. Proposal for Children’s Media Use. The Japan Pediatric Association [updated 2004 Feb; Cited 2017 Apr 19]. Available from: http://jpa.umin.jp/download/media/proposal02.pdf (in Japanese).

4. Mark AE, Janssen I. Relationship between screen time and metabolic syndrome in adolescents. J Public Health (Oxf). 2008; 30(2):153–160.

5. Gottsmaker SL, Must A, Sobol AM, Peterson K, Colditz GA, Dietz WH. Television viewing as a cause of increasing obesity among children in the United States, 1986–1990. Arch Pediatr Adolesc Med. 1996;150(4):356–362. Review.
6. Andersen RE, Crespo CJ, Bartlett SJ, Cheskin LJ, Pratt M. Relationship of physical activity and television watching with body weight and level of fatness among children: results from the Third National Health and Nutrition Examination Survey. *JAMA*. 1998;279(12):938–942.

7. Huesmann LR, Moise-Titus J, Podolski CL, Eron LD. Longitudinal relations between children’s exposure to TV violence and their aggressive and violent behavior in young adulthood: 1977–1992. *Dev Psychol*. 2003;39(2):201–221.

8. Johnson JG, Cohen P, Smailes EM, Kasen S, Brook JS. Television viewing and aggressive behavior during adolescence and adulthood. *Science*. 2002;295(5564):2468–2471.

9. Borzekowski DL, Robinson TN. The remote, the mouse, and the no. 2 pencil: the household media environment and academic achievement among third grade students. *Arch Pediatr Adolesc Med*. 2005;159(7):607–613.

10. Hoyos Cillero I, Jago R. Systematic review of correlates of screen-viewing among young children. *Prev Med*. 2010;51(1):3–10.

11. Jiang XX, Hardy LL, Ding D, Baur LA, Shi HJ. Recreational screen-time among Chinese adolescents: a cross-sectional study. *J Epidemiol*. 2014;24(5):397–403. Epub 2014 Jun 14.

12. Brindova D, Pavelka J, Ševčíkova A, et al. How parents can affect excessive spending of time on screen-based activities. *BMC Public Health*. 2014;14:1261.

13. Community Preventive Services Task Force. reducing children’s recreational sedentary screen time: recommendation of the Community Preventive Services Task Force. *Am J Prev Med*. 2016;50(3):416–418.

14. Liu J, Sekine M, Tatsuse T, Hamanishi S, Fujimura Y, Zheng X. Family history of hypertension and the risk of overweight in Japanese children: results from the Toyama Birth Cohort Study. *J Epidemiol*. 2014;24(4):304–311. Epub 2014 May 24.

15. Sekine M, Yamagami T, Kaganimori S. Lifestyle and childhood obesity: results from the Toyama Birth Cohort Study. *Ped Cardiol Card Surg*. 2008;24(5):589–597.

16. Birbilis M, Moschonis G, Mougiou V, Manios Y. Healthy Growth Study’ group. Obesity in adolescence is associated with perinatal risk factors, parental BMI and sociodemographic characteristics. *Eur J Clin Nutr*. 2013;67(1):115–121.

17. Environment of Internet Use for Youth. Online government survey 2014 [updated 2015 Feb; Cited 2017 Apr 19]. Available from: http://www8.cao.go.jp/youth/youth-harm/chousa/h27/net-jittai/pdf/sokuhou.pdf (in Japanese).

18. The Super Shokuhou Project. Ministry of Education, Culture, Science and Technology in Japan (MEXT) [updated 2016 Apr; Cited 2017 Apr 19]. Available from: http://www.mext.go.jp/a_menu/sports/syokuiku/1353368.htm (in Japanese).

19. Nakahori N, Sekine M, Yamada M, Tatsuse T. The relationship between home environment and children’s dietary behaviors, lifestyle factors, and health: Super Food Education School Project by the Japanese Ministry of Education, Culture, Sports, Science and Technology. *Nihon Kosho Eisei Zasshi*. 2016;63(4):190–201 (in Japanese).

20. Nihon Kodomo Katei Sougoukennkyuuso. *Almanac of data on Japanese children* 2016. Tokyo, Japan: KTC chuushuppan (in Japanese).

21. Chen X, Sekine M, Hanamishi S, et al. Validation of a self-reported physical activity questionnaire for schoolchildren. *J Epidemiol*. 2003;13:278–287.

22. Gaias A, Sekine M, Chen X, Hanamishi S, Kaganimori M. Sleep parameters recorded by Actiwatch in elementary school children and junior high school adolescents: schooldays vs weekends. *Sleep Hynp*. 2004;6:65–76.

23. *Manual for Health Check among school children, revised version*. Nihon Gakko Hokenkyoukai; Tokyo: Nihon Gakko Hokenkyoukai; 2006 (in Japanese).

24. Ishikawa G, Naiki Y, Horikawa R, Yokoya S, Tanaka T. Correlation between Body Mass Index z score and percent obesity in Japanese children in Akita prefecture. *Himankenkyu*. 2008;14(2):159–165.

25. Berkman LF, Breslow L. *Health and ways of living*. New York: Oxford University Press; 1983.

26. National Assessment of Academic Ability. 2008. National Institute for Education Policy Research [updated 2009 Mar; Cited 2017 July 5]. Available from: http://www.mext.go.jp/b_menu/shingi/chousa/ shotou/053/shiryo/_icsFiles/afiedfile/2009/03/09/1236114.3.pdf (in Japanese).

27. Bleakley A, Jordan AB, Hennessy M. The relationship between parents’ and children’s television viewing. *Pediatrics*. 2013;132(2):e364–e371. Epub 2013 Jul 15.

28. Jago R, Edwards MJ, Urbanski CR, Sebire SJ. General and specific approaches to parenting media: a systematic review of current measures, associations with screen-viewing, and measurement implications. *Child Obes*. 2013;9(Suppl):S51–S72.

29. LeBlanc AG, Broyles ST, Ch autop JP, et al. Correlates of objectively measured sedentary time and self-reported screen time in Canadian children. *Int J Behav Nutr Phys Act*. 2015;12:38.

30. Iannotti RJ, Kogan MD, Janssen I, Boyce WF. Patterns of adolescent physical activity, screen-based media use, and positive and negative health indicators in the U.S. and Canada. *J Adolesc Health*. 2009;44(5):493–499.

31. Ogunleye AA, Voss C, Sandercro GR. Delayed bedtime due to screen time in schooldays: importance of area deprivation. *Pediatr Int*. 2015;57(1):137–142.

32. Barradas DT, Fulton JE, Blanck HM, Huhman M. Parental influences on youth television viewing. *J Pediatr*. 2005;147(4):369–373.e1–4. Epub 2007 Aug 24.

33. Tremblay MS, LeBlanc AG, Kho ME, et al. Systematic review of sedentary behaviour and health indicators in school-aged children and youth. *Int J Behav Nutr Phys Act*. 2011;8:98.

34. Keane E, Li X, Harrington JM, Fitzgerald AP, Perry II, Kearney PM. Physical activity, sedentary behaviour and the risk of overweight and obesity in school aged children. *Pediatr Exerc Sci*. 2017;29(3):408–418.

35. Moradi G, Mostafavi F, Azadi N, Esmaeilsabab N, Nouri B. Evaluation of screen time activities and their relationship with physical activity, overweight and socioeconomic status in children 10–12 years of age in Sanandaj, Iran: A cross-sectional study in 2015. *Med J Islam Repub Iran*. 2016;30:448. eCollection 2016.

36. Bell L, Ullah S, Olds T, Magarey A, Leslie E, Jones M, et al. Prevalence and socio-economic distribution of eating, physical activity and sedentary behaviour among South Australian children in urban and rural communities: baseline findings from the OPAL evaluation. *Public Health*. 2016;140:196–205. Epub 2016 Aug 11.

37. Magee CA, Caputi P, Iverson DC. Are parents’ working patterns associated with their child’s sleep? An analysis of dual-parent families in Australia. *Sleep Biol Rhythms*. 2012;10:100–108.

38. Levine EL, Waite MB. Television viewing and attentional abilities in fourth and fifth grade children. *J Appl Dev Psychol*. 2000;21(6):667–679.

39. Inoue S, Yorifuji T, Kato T, Sunada S, Doi H, Kawachi I. Children’s media use and self-regulation behavior: longitudinal associations in a nationwide Japanese study. *Matern Child Health J*. 2016;20(10):2084–2099.