

1 Adolescents' future smoking, media exposure, & IHL

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3 **Media exposure, interactive health literacy, and adolescents' susceptibility to future smoking**

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3 **Abstract**

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5 **Background:** Few studies have investigated interactive health literacy (IHL)'s relationship with
6 adolescents' smoking-related behavior. This study investigated IHL's association with adolescents'
7 susceptibility to future smoking.
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11 **Materials and methods:** We conducted a school-based cross-sectional study of Japanese students
12 enrolled in public junior high school, grades 7–9 (N = 1,937), who completed a self-report
13 questionnaire. Variables were grade, gender, media exposure (consumption of television (TV), internet,
14 and magazines), IHL (interest in learning about health, understanding what they hear about health,
15 trying to follow what is taught about health), and susceptibility to future smoking.
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23 **Results:** Significant findings were: (1) media exposure was positively associated with adolescents'
24 susceptibility to future smoking (TV: $P < 0.01$, internet: $P < 0.01$, magazines: $P < 0.01$); (2) IHL was
25 negatively associated with adolescents' susceptibility to future smoking (interest in learning about
26 health: $P < 0.001$; understanding what they hear about health: $P < 0.05$; trying to follow what is taught
27 about health: $P < 0.001$). IHL's influence on susceptibility to future smoking was found to be
28 marginally stronger than that of media exposure.
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36 **Conclusion:** School health-education programs that promote adolescents' IHL may effectively reduce
37 adolescents' susceptibility to future smoking.
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Adolescents' future smoking, media exposure, & IHL

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Introduction

Smoking is the most common cause of preventable death, causing cardiovascular disease, chronic obstructive pulmonary disease, and lung cancer [1]. In Japan, 196,000 people die annually due to smoking [2]. Adolescents are particularly susceptible to initiating smoking [3]. Adolescent smoking risk factors include gender [4], socioeconomic status [4], sensation seeking [5], parenting practices [6], family and peers' smoking [7], and media exposure [8-16].

Adolescents regularly watch TV programs including dramas, cartoons, variety shows, music programs, and movies [17]. A previous study reported that 7.5% and 14.2% of TV dramas depict smoking and smoking-related items (i.e., ashtrays, cigarettes, brand appearances, or matches/lighters), respectively [8]. Adolescents regularly use the internet; a previous study reported that increased internet usage significantly affects future smoking [14, 17]. Web pages favored by adolescents often contain pro-smoking or smoking-related imagery [18]. Some pages sell, or link to pages selling, tobacco products [18]. Japanese comic magazines for adolescents often depict smoking, or smoking-related items or conversations [15]. A previous study reported that students perceive smoking imagery in magazines as attractive, sociable, and reassuring, and that such imagery supported students' perception of smoking and reinforced their identities as smokers [16].

Smoking prevention programs for adolescents are important, since the intention to smoke partially predicts future smoking behavior [19, 20]. Health literacy [21, 22] is effective in reducing adolescent smoking behavior. Health literacy is defined as "the degree to which individuals have the capacity to obtain, process, and understand the basic health information and services needed to make appropriate health decisions" [23]. This definition emphasizes the importance of developing adolescents' ability to access and utilize various types of health information, products, and services, and make healthy decisions [24]. Developing adolescents' health literacy is essential to improving their adult smoking-related behavior [25].

Nutbeam (2000) categorized health literacy into functional health literacy, IHL, and critical

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3 health literacy [26]. Functional health literacy is the ability to understand information about health risks
4 and health service utilization [26]. IHL is the ability to act independently on one's knowledge and
5 motivation, and the self-confidence to extract information, derive meaning from different forms of
6 communication, and apply new information to changing circumstances. School health-education
7 programs that develop personal skills, social skills, and behavioral outcomes address IHL [26]. Critical
8 health literacy involves using more advanced cognitive skills, including critical analysis and evaluation
9 of information, to exert control over life events and situations [26]. Media literacy is one type of critical
10 health literacy [25]. Previous research has suggested that higher functional health literacy is associated
11 with non-smoking among adults [27, 28]. Primack et al. (2006) developed a smoking media literacy
12 scale for adolescents [29, 30]. Studies using Primack's scale found that higher smoking media literacy
13 is associated with lower susceptibility to future smoking [31, 32]; however, few studies have examined
14 IHL's association with adolescents' smoking-related behavior. This study therefore investigated IHL's
15 association with adolescents' susceptibility to future smoking.
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31 Method

32 We conducted a school-based cross-sectional study using an anonymous, self-administered
33 paper and pencil questionnaire. We used a convenient sample of seven public junior high schools in
34 Miyazaki prefecture, Japan. Participants were junior high school students in grades 7–9 (n = 2,161).
35 The study's objectives were explained to students and their parents in writing. The questionnaire was
36 then administered in the classroom. Students were aware that participation was voluntary. Completion
37 of the questionnaire was considered to indicate consent to participate. Questionnaires with any missing
38 values were excluded. Data were collected in February 2013. Variables were grade, gender, media
39 exposure (TV, internet, magazines), IHL (interest in learning about health, understanding what they
40 hear about health, trying to follow what is taught about health), and susceptibility to future smoking.
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53 Items measuring media exposure inquired about students' time spent watching TV, using the
54 internet, and frequency of reading magazines. We measured students' time spent watching TV, and
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3 internet use per day on weekdays to ensure adequate reliability and validity [33]. An example item
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5 asked students how much time they spent watching TV and using the internet on weekdays. Response
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7 choices were 1 = "seldom," 2 = "less than 30 minutes," 3 = "30 minutes to 1 hour," 4 = "1 to 2 hours,"
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9 5 = "2 to 3 hours," and 6 = "more than 3 hours." Items measuring students' frequency of reading
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11 magazines asked how often students read magazines per week. Response choices were 1 = "never," 2
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13 = "1 or 2 days per week," 3 = "3 or 4 days per week," 4 = "5 or 6 days per week," and 5 = "every day."

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15 We measured IHL using items that were used by Brown *et al.* [34]. Items focused on
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17 adolescents' capacity to acquire and use new information. Three items, rated on a 4-point Likert scale,
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19 measured students' (1) interest in learning about health (2) understanding what they hear about health,
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21 and (3) trying to follow what is taught about health. Response options for interest in learning about
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23 health were 1 = "very uninterested," 2 = "somewhat uninterested," 3 = "somewhat interested," and 4 =
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25 "very interested." Response options for understanding what was hear about health were 1 = "very hard
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27 to understand," 2 = "somewhat hard to understand," 3 = "somewhat easy to understand," and 4 =
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29 "very easy to understand." Response options for trying to follow what is taught about health were 1 =
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31 "never," 2 = "hardly ever," 3 = "sometimes," and 4 = "all the time."

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33 Items measuring students' susceptibility to future smoking inquired about students' intentions
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35 to smoke as adults [19, 20]. Response options were 1 = "will not," 2 = "probably will not," 3 =
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37 "probably will," and 4 = "will." We used descriptive statistics to summarize the variables'
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39 characteristics. We performed multiple regression analysis to analyze media exposure and IHL's
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41 association with susceptibility to future smoking. We used SPSS version 22.0 for Windows (SPSS
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43 Japan, Tokyo, Japan). Statistical significance was set at $P < 0.05$. The ethical committee of the
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45 Miyazaki University Faculty of Medicine approved this study. The study protocol complied with the
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47 World Medical Association Declaration of Helsinki regarding ethical conduct of research involving
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49 human subjects.
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2 3 **Results**

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5 Of the 2,161 students given the questionnaire, 1,987 (91.9%) returned it. After excluding
6 questionnaires with any missing values, 1,937 (89.6%) were analyzed.

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9 Table 1 details the variables' characteristics. The final sample consisted of 1,028 males (53%)
10 and 909 females (47%). Regarding media exposure, 73% of respondents spent more than 1 hour per
11 day watching TV. In contrast, 42% of respondents seldom used the internet, and 44% never read
12 magazines. Regarding IHL, 34% of respondents were very interested or somewhat interested in
13 learning about health. Sixty-three percent of respondents answered that understanding what they hear
14 about health is very easy or somewhat easy. Sixty-six percent of respondents were trying to follow
15 what is taught about health all the time, or sometimes. Regarding susceptibility to future smoking,
16 87% of respondents indicated that they were not susceptible at all, or hardly susceptible.

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18 Table 2 shows the results of the multiple regression analysis of media exposure and IHL's
19 association with susceptibility to future smoking. Regarding media exposure, susceptibility to future
20 smoking was significantly positively associated with time spent watching TV ($P < 0.01$), time spent
21 using the internet ($P < 0.01$), and frequency of reading magazines ($P < 0.01$). Regarding IHL, students'
22 interest in learning about health ($P < 0.001$), understanding what they hear about health ($P < 0.05$), and
23 trying to follow what is taught about health ($P < 0.001$) were significantly negatively associated with
24 susceptibility to future smoking. IHL's influence on susceptibility to future smoking was found to be
25 marginally stronger than that of media exposure.

26 27 28 **Discussion**

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30 Our results indicate that media exposure is significantly positively associated with adolescents'
31 susceptibility to future smoking. A previous study reported that television viewing has a dose-response
32 relationship with adolescents' initiation of smoking [9]. Television programs contain a substantial
33 number of positive images of smoking, as do movies [10], dramas [8], and music videos [11], which
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3 may encourage adolescents to smoke. Web pages often contain pro-smoking imagery [18], or sell, or
4 link to pages selling, tobacco products [18]. Magazines contain images of smoking, or smoking-related
5 items or conversations [15]. Previous studies have reported that parental imposition of restrictions on
6 adolescents' watching movies strongly reduces the likelihood of those adolescents' initiating smoking
7 [35]. Interventions that reduce adolescents' media exposure may reduce adolescents' likelihood of
8 initiating smoking. Reduction of media depiction of smoking may reduce adolescents' susceptibility to
9 future smoking. Further, media-conveyed anti-smoking messages have been shown to lower the rate at
10 which adolescents try smoking [36].

21 Our results suggest that improving IHL may reduce adolescents' susceptibility to future
22 smoking. School-based health-education programs addressing health literacy focus on IHL [34].
23 Increasing adolescents' interest in learning about health, understanding what they hear about health
24 and trying to follow what is taught about health may lower their susceptibility to future smoking. A
25 previous study reported that individuals who sought health information on the internet were more
26 likely to be health-oriented [37]; our results are consistent with this finding. This suggests that
27 health-oriented students are motivated to seek health information, and that it is important to promote
28 students' health-orientation. School health-education programs must facilitate the location, acquisition,
29 and critical appraisal of high-quality health information [38]. Ghaddar *et al.* showed that exposure to
30 credible sources of online health information is associated with improved health literacy. School health
31 education may thus effectively promote health literacy by providing credible online health information
32 resources [39].

47 Our study has several limitations. First, it was cross-sectional, and was not designed to
48 evaluate participants' future smoking. However, previous studies have reported that adolescents'
49 intention to smoke predicts future smoking behavior [19, 20]. Our results regarding adolescents'
50 susceptibility to future smoking may therefore indicate later smoking behavior. Second, our sample
51 may not be representative, as it was a convenience sample. Thus, the results should be generalized

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3 with caution. Third, we did not measure socioeconomic status [4] or smoking among participants'
4 family members and peers [7], which are known confounding factors influencing smoking behavior.
5 However, previous studies have found that media exposure uniquely influences adolescents' smoking
6 behavior, even after controlling for these confounds. Morgenstern *et al.* (2013) found a significant
7 association between movie smoking and adolescent smoking, stratified by family affluence and
8 parents' migration history, while controlling for covariates including age, gender, school performance,
9 TV exposure, sensation seeking, and rebelliousness [40]. Scull *et al.* (2013) found that adolescents'
10 identification with alcohol and tobacco advertisements, and perception of their desirability and realism,
11 predicted intentions to smoke, after controlling for parental and peer influence [41]. These findings are
12 consistent with our results. Fourth, the validity and reliability of this study's IHL measures, which are
13 the same as in Brown *et al.* [34], have not been examined, and other measures have not yet been
14 developed. Additional development and testing of IHL measures is therefore needed. Finally, we used
15 a single question to assess susceptibility to future smoking. Generally, single-question measurements
16 are low in validity. However, this measure was shown to have adequate reliability and validity [19, 20].
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34 Conclusion

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36 Media exposure is positively associated with adolescents' susceptibility to future smoking.
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38 Improved IHL is associated with a reduction in adolescents' susceptibility to future smoking. IHL's
39 influence on susceptibility to future smoking is marginally stronger than that of media exposure.
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41 School health-education programs that promote adolescents' IHL may be effective in lowering
42 adolescents' susceptibility to future smoking.
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Table 1. Characteristics of study variables.

Grade	7 th	628 (32%)
	8 th	598 (31%)
	9 th	711 (37%)
Gender	Male	1028 (53%)
	Female	909 (47%)
Media exposure (TV)	Seldom	76 (4%)
	Less than 30 minutes	92 (5%)
	30 minutes to 1 hour	349 (18%)
	1 to 2 hours	706 (36%)
	2 to 3 hours	399 (21%)
	More than 3 hours	315 (16%)
Media exposure (internet)	Seldom	803 (42%)
	Less than 30 minutes	293 (15%)
	30 minutes to 1 hour	353 (18%)
	1 to 2 hours	271 (14%)
	2 to 3 hours	104 (5%)
	More than 3 hours	113 (6%)
Media exposure (magazine)	None	847 (44%)
	1 or 2 days per week	753 (39%)
	3 or 4 days per week	221 (11%)
	5 or 6 days per week	65 (3%)
	Every day	51 (3%)
Interest in learning about health	Very interested	73 (4%)
	Somewhat interested	576 (30%)
	Somewhat uninterested	963 (50%)
	Very uninterested	325 (17%)
Understanding what they hear about health	Very easy to understand	183 (9%)
	Somewhat easy to understand	1044 (54%)
	Somewhat hard to understand	611 (32%)
	Very hard to understand	99 (5%)
Trying to follow what is taught about health	All the time	202 (10%)
	Sometimes	1078 (56%)
	Hardly ever	524 (27%)
	Never	133 (7%)
Susceptibility to future smoking	Not susceptible at all	1274 (66%)
	Hardly susceptible	411 (21%)
	Probably susceptible	158 (8%)
	Very susceptible	94 (5%)

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Table 2. Multiple regression analysis of media exposure and IHL's association with susceptibility to future smoking

	Crude				Adjusted				
	B	SE	t	p	B	SE	β	t	p
Grade	-0.045	0.023	-1.966	<0.05	-0.038	0.022	-0.037	-1.704	0.1
Gender	0.271	0.038	7.172	<0.001	0.295	0.037	0.175	7.876	<0.001
Media exposure									
TV	0.069	0.015	4.517	<0.001	0.049	0.015	0.074	3.295	<0.01
Internet	0.045	0.012	3.666	<0.001	0.040	0.012	0.073	3.288	<0.01
Magazine	0.021	0.020	1.023	0.3	0.053	0.020	0.059	2.624	<0.01
IHL									
Interest in learning about health	-0.208	0.025	-8.396	<0.001	-0.125	0.028	-0.113	-4.418	<0.001
Understanding what they hear about health	-0.169	0.026	-6.394	<0.001	-0.069	0.028	-0.059	-2.427	<0.05
Trying to follow what is taught about health	-0.212	0.025	-8.444	<0.001	-0.106	0.029	-0.094	-3.628	<0.001

 $R^2 = 0.089$