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Relation between communicative and critical health literacy and physical activity in Japanese adults: a cross-sectional study

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Abstract Communicative and critical health literacy (HL) are thought to play an important role in improving healthy behaviours. However, no study has examined the relation between these types of HL and physical activity. The purpose of this study was to examine the relation of these types of HL to overall ("total") physical activity and the different domains (work-related "work", travel-related "travel", and recreational "recreation") of physical activity in Japanese adults. This study was an internet-based cross-sectional survey. The analysis included 3,132 participants. The survey included the following variables: 1) communicative and critical HL, 2) physical activity measured by the Global Physical Activity Questionnaire (GPAQ), and 3) confounders (gender, age, marital status, living with family, household motor vehicles, body mass index, household income, educational status, and employment status). To examine the relation of communicative and critical HL to physical activity, logistic regression analysis was performed to calculate the odds ratio (OR) and 95% confidence interval (95% CI) for "active" physical activity in total and each domain ("work", "travel", and "recreation") of physical activity stratified by gender. In men, high HL was significantly related to total (OR: 1.81, 95% CI: 1.47-2.22), travel (1.76, 1.42-2.18), and recreation physical activity (1.75, 1.39-2.21); but not significantly related to work physical activity (1.22, 0.94-1.58). In women, high HL was significantly related to total (1.43, 1.15-1.77), travel (1.38, 1.11-1.71), and recreation physical activity (2.12, 1.63-2.76); but not significantly related to work physical activity (1.31, 0.97-1.78). This study suggests that a high level of communicative and critical HL was significantly related to high level of total, travel-related, and recreational physical activity in Japanese adults.
Keywords : health literacy, physical activity, Japanese, cross-sectional study, health education

Introduction

Physical inactivity is a major risk factor for all-cause mortality and non-communicable diseases. In recently years, the proportion of insufficient physical activity in adults around the world was about 31.1%[1,2]. At the same time, among Japanese adults, the proportion of insufficient physical activity was over 40%, and the amount of physical activity had declined over the previous decade[1,3]. Therefore, insufficient physical activity is a public health issue, and it is necessary to develop a physical activity promotion program that considers its related factors.

Health literacy (HL) has begun to be recognized as a key factor associated with health conditions and behavior. Sørensen et al. defined HL as follows: "Health literacy is linked to literacy and entails people's knowledge, motivation and competences to access, understand, appraise, and apply health information in order to make judgments and take decisions in everyday life concerning healthcare, disease prevention and health promotion to maintain or improve quality of life during the life course"[4]. A systematic review that examined the relations of HL to health condition and health behavior outcomes, reported that low HL was consistently related to some health outcomes[5]. Thus, HL is a relevant factor for health outcomes.

Furthermore, HL has been classified into the following three types: 1) basic/functional literacy, 2) communicative/interactive literacy, and 3) critical literacy[6]. While basic/functional literacy is a basic ability such as reading and writing, communicative/interactive literacy and critical literacy concern developing ability with social skills such as communication and information criticism[6].

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Therefore, research focusing on communicative and critical HL has becoming increasingly important[7,8]. A few studies have indicated that high communicative and high critical HL contribute to self-management for chronic diseases more effectively than functional HL[9-11]. Further, in Japan, high levels of these types of HL were significantly related to better self-rated health among Japanese adults[12].

Some studies have already examined the relation between HL and physical activity, but three limitations remain. First, because some studies have not shown consistent results of the relation between HL and physical activity[5,13-18], it is important to examine this relation further. Second, since there isn't any known study that has examined the relation of communicative and critical HL to physical activity, it is necessary to conduct research for examining their relation. And, third, since there isn't any research examining the relation between HL and domains of physical activity (DPA; e.g., work-related "work", travel-related "travel", and recreational "recreation"). It is important to consider the target domain when developing programs to promote physical activity[19], and gain an understanding of the relation between HL and DPA for developing programs to promote HL in the future. Moreover, the factors related to physical activity differed between gender[20]; however, no study has used a gender-stratified analysis to examine the relation between HL and physical activity. Therefore, the aim of this study was to examine the relation of communicative and critical HL to DPA among Japanese adults.

Materials and Methods

Participants

This study used the dataset analyzed in our previous study[21], which was an Internet-based cross-sectional survey of 3,269 participants selected from a pool of 106,281 individuals registered with a Japanese Internet research company in 2014. The company has access to each registered individual's sociodemographic data, which we were able to use to target specific attributes. The participants were 30 to 59 years old and were selected in accordance with their distribution by gender, age, and household income in Japan[22,23]. A total of 8,284 individuals were randomly selected and sent an e-mail invitation to the Internet-based survey. Consequently, 3,269 participants responded (response rate: 39.5%). However, 137 participants with missing data were excluded, and the final sample included 3,132 participants (final response rate: 35.1%). The e-mail invitation contained a link to a secure version of the questionnaire website, and the participants could log in to the website by using an ID and password. The participants received a point worth 100 yen (1 U.S. dollar was approximately equivalent to 102 yen and €1 to 140 yen at the time). All the participants read an online informed consent form approved by an ethics committee, and voluntarily completed the demographic data form and clicked on the "agree" button. The study received approval from the Academic Research Ethical Review Committee of Waseda University, Japan (Application Number: 2013-249; Jan 17, 2014).

Measurements

Physical activity

The World Health Organization (WHO) developed the Global Physical Activity Questionnaire version 2 (GPAQ v2) as a modification of the International Physical Activity Questionnaire (IPAQ), which can be used in multi-ethnic settings[24]. It was used to estimate the weekly total quantity (in minutes) of moderate-to-vigorous physical activity lasting for at least 10 minutes per session across three separate domains (work, travel, and recreation). Previous studies have shown that the GPAQ has good reliability and validity[25,26]. For statistical analysis, each DPA was categorized into "active" (physical activity performed for 10 continuous minutes at least once a week) or "inactive" (physical activity not performed for 10 continuous minutes at least once a week). Furthermore, total physical activity was categorized according to WHO's physical activity recommendations (active: ≥150 min/week, inactive: <150 min/week)[27]. The data was handled with the same methods as our previous study[21].

Communicative and critical health literacy

The communicative and critical HL scale developed by Ishikawa et al.[16] was used in this study. This scale contains 3 items about communicative HL (i–iii) and 2 items about critical HL (iv–v). These items focus on whether the participants are able to (i) collect health-related information from various sources, (ii) extract the required information, (iii) understand and communicate the obtained information, (iv) consider the credibility of the information, and (v) make decisions based on the information, specifically in the context of health-related issues. Each item is rated on a 5-point scale from 1 (strongly disagree) to 5 (strongly agree). The average of the raw scores for the five items was calculated to obtain an overall communicative and critical HL score for each subject. The participants were divided into two groups according to the median score of communicative and critical HL (high HL, ≥3.8; low HL, <3.8), similar to a previous study[16].

Confounders

The demographic variables collected from the research company included gender (male or female), age (continuous), marital status (married or unmarried), living with family (categorized as Yes or No), household income (categorized as <3, 3–5, 5–7, 7–10, or ≥10 million yen), educational level (categorized as junior high and high school graduation, two-year college degree or equivalent, or four-year college and higher degree), and employment status (categorized as non-full-time or full-time worker).

Participants self-reported the number of household motor vehicles (categorized as none, 1, or 2+) and body height and weight to allow the calculation of body mass index (BMI: body weight in kg/body height in m^2; continuous).

Statistical analysis

All statistical analyses were stratified by gender. Descriptive statistics were used to characterize the participants and cross-tabulated to examine the relation of HL to the confounders and DPA. Categorical variables were analyzed using the chi-square test, and continuous variables were tested using the t-test. To examine the relation between HL and DPA after adjusting confounders, binominal logistic regression analysis was conducted to calculate the odds ratio (OR) and 95% confidence interval (CI) for "active" physical activity. The dependent variable was DPA and total physical activity, and the independent variables were HL and all confounders (gender, age, marital status, living with family, household income, educational level, employment status, household motor vehicles, and BMI). Significance level was set at $p < 0.05$, and all analyses were conducted with SPSS 22.0 for Windows (IBM Japan Inc., Tokyo, Japan, 2013).

Results

Subjective characteristics

Table 1 shows the characteristics of the participants. A total of 1,579 men (50.6%) and 1,553 women (49.4%) participated in this study. In men, 831 participants (52.6%) were high HL, which was significantly related to age, household income, educational status and employment status. Furthermore, the number of male participants with "active" total physical activity was 761 (48.1%), which was significantly related to HL. In women, 838 participants (54.0%) were high HL, which was significantly related to age, household income, and educational status and BMI. The number of female participants with "active" total physical activity was 634 (40.8%), which was significantly related to HL.

Health literacy and physical activity

Table 2 shows the odds ratio of "active" physical activity by HL after adjustment for confounders. In men, high HL was significantly related to more total (OR: 1.81, 95% CI: 1.47-2.22), travel (1.76, 1.42-2.18), and "recreation" physical activity (1.75, 1.39-2.21), but not significantly related to "work" physical activity (1.22, 0.94-1.58). In women, high HL was significantly related to total (1.43, 1.15-1.77), travel (1.38, 1.11-1.71), and "recreation" physical activity (2.12, 1.63-2.76), but not significantly related to "work" physical activity (1.31, 0.97-1.78).

Discussion

This is the first study to examine the relation between communicative and critical HL and DPA in Japanese adults. To the best of our knowledge, no previous study has examined this relation. Our study reveals that high communicative and critical HL is significantly related to total physical activity in both genders. These results are in agreement with a previous study that reported that functional HL was related to physical activity in >15-year-old Australians[13]. Although there are no studies that examine the mechanisms linking communicative and critical HL to total physical activity, a few studies exist that focus on the mechanism between functional HL and physical activity. Osborn et al. reported that, in patients with hypertension, functional HL promoted physical activity through knowledge and self-efficacy[17]. Moreover, Dominick et al. conducted an intervention study, and reported that functional HL at baseline was a predictor of improving self-efficacy for physical activity at follow-up[15]. Therefore, self-efficacy and knowledge could be the mediators linking HL to physical activity. In future studies, it is necessary to examine this mechanism by focusing on self-efficacy and linking communicative and critical HL to total physical activity.

In this study, high communicative and critical HL was more significantly related to "travel" and "recreation" physical activity in both genders. Von Wagner et al. and Chang reported that functional HL was not related to exercise[14,18], whereas Ishikawa et al. reported that communicative and critical HL was significantly related to exercise among Japanese adults[16]. Therefore, "recreation" physical activity could be related to communicative and critical HL, but not functional HL. There is no study that has examined the relation between HL and "travel" physical activity. A previous study has shown that "travel" physical activity was significantly related to self-efficacy for physical activity[28]; this suggestion could imply that HL is related to "travel" physical activity through the same mechanism as it is to total physical activity. "Work" physical activity, including daily work (e.g., housework, labor), was not significantly related to communicative and critical HL, and did not effect daily work despite high HL.

This study has some limitations. First, this study may have a selection bias, because the participants were selected from an Internet research company's participants. Second, these results cannot refer to a casual relation of communicative and critical HL to physical activity because this is a cross-sectional study. Despite these limitations, this study contributes to a better understanding of the relationships between HL and physical activity.

In conclusion, our results reveal that communicative and critical HL is significantly related to "travel" and "recreation" physical activity, in addition to total physical activity, in Japanese adults. In future studies, one must examine the mechanisms that link communicative and critical HL to physical activity, and conduct an intervention study that improves HL that leads to increased physical activity.

Table 1. Characteristics of the participants, stratified by health literacy

	Men n = 1,579					Women n = 1,553				
	Low HL (n=748)		High HL (n=831)		p Value*	Low HL (n=715)		High HL (n=838)		p Value*
	n	%	n	%		n	%	n	%	
Age, years										
30–39	276	36.9	264	31.8		275	38.5	257	30.7	
40–49	271	36.2	296	35.6	< 0.05	254	35.5	294	35.1	< 0.001
50–59	201	26.9	271	32.6		186	26.0	287	34.2	
Mean ± SD	43.5 ± 8.01		44.9 ± 7.98		< 0.001	43.1 ± 7.93		44.9 ± 8.12		< 0.001
Marital status										
Married	352	47.1	384	46.2	0.735	249	34.8	262	31.3	0.137
Not married	396	52.9	447	53.8		466	65.2	576	68.7	
Living with family										
No	160	21.4	205	24.7	0.123	91	12.7	99	11.8	0.584
Yes	588	78.6	626	75.3		624	87.3	739	88.2	
Household income										
<3 million yen	267	35.7	234	28.2		262	36.6	218	26.0	
3-5 million yen	197	26.3	193	23.2		180	25.2	211	25.2	
5-7 million yen	115	15.4	138	16.6	< 0.001	112	15.7	145	17.3	< 0.001
7–10 million yen	112	15.0	138	16.6		104	14.5	137	16.3	
≥10million yen	57	7.6	128	15.4		57	8.0	127	15.2	
Educational status										
Junior high or high school graduation	218	29.1	194	23.3		240	33.6	175	20.9	
2 years college degree or equivalent	127	17.0	130	15.6	< 0.05	266	37.2	342	40.8	< 0.001
4 years college or higher degree	403	53.9	507	61.0		209	29.2	321	38.3	
Employment status										
Non-full time	201	26.9	174	20.9	< 0.01	502	70.2	588	70.2	0.985
Full time	547	73.1	657	79.1		213	29.8	250	29.8	
Household motor vehicles (no.)										
0	189	25.3	179	21.5		175	24.5	180	21.5	
1	329	44.0	376	45.2	0.199	308	43.1	372	44.4	0.369
≥ 2	230	30.7	276	33.2		232	32.4	286	34.1	
Body mass index, kg/m^2										
< 25	513	68.6	598	72.0	0.142	613	85.7	754	90.0	< 0.05
≥ 25	235	31.4	233	28.0		102	14.3	84	10.0	
Mean ± SD	23.6 ± 3.79		23.6 ± 3.77		0.830	21.6 ± 3.84		21.2 ± 3.09		< 0.05
Physical activity										
Total										
Inactive	447	59.8	371	44.6	< 0.001	461	64.5	458	54.7	< 0.001
Active	301	40.2	460	55.4		254	35.5	380	45.3	
Work										
Inactive	611	81.7	665	80.0	0.403	628	87.8	710	84.7	0.077
Active	137	18.3	166	20.0		87	12.2	128	15.3	
Travel										
Inactive	468	62.6	409	49.2	< 0.001	422	59.0	425	50.7	< 0.01
Active	280	37.4	422	50.8		293	41.0	413	49.3	
Recreation										
Inactive	584	78.1	543	65.3	< 0.001	610	85.3	597	71.2	< 0.001
Active	164	21.9	288	34.7		105	14.7	241	28.8	

* Significantly different between the Low HL and High HL group

Table 2. Odds ratios for active physical activity by health literacy

	Low HL	High HL	
	Ref	Adjusted odds ratio (95% CI)*	p-value
Men (n = 1,579)			
Total	1.00	1.81 (1.47-2.22)	< 0.001
Work	1.00	1.22 (0.94-1.58)	0.143
Travel	1.00	1.76 (1.42-2.18)	< 0.001
Recreation	1.00	1.75 (1.39-2.21)	< 0.001
Women (n = 1,553)			
Total	1.00	1.43 (1.15-1.77)	< 0.01
Work	1.00	1.31 (0.97-1.78)	0.077
Travel	1.00	1.38 (1.11-1.71)	< 0.01
Recreation	1.00	2.12 (1.63-2.76)	< 0.001

* OR adjusted for age, marital status, living with family, household motor vehicles, BMI, household- income, educational status, employment status

Conflict of Interests

The authors declare that they have no conflict of interests.

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References

1) Hallal PC, Andersen LB, Bull FC, Guthold R, Haskell W and Ekelund U; Lancet Physical Activity Series Working Group. 2012. Global physical activity levels: surveillance progress, pitfalls, and prospects. *Lancet* 380: 247-257. doi: 10.1016/S0140-6736(12)60646-1.
2) Lee IM, Shiroma EJ, Lobelo F, Puska P, Blair SN and Katzmarzyk PT; Lancet Physical Activity Series Working Group. 2012. Effect of physical inactivity on major non-communicable diseases worldwide: an analysis of burden of disease and life expectancy. *Lancet* 380: 219-229. doi: 10.1016/S0140-6736(12)61031-9.
3) Inoue S, Ohya Y, Tudor-Locke C, Tanaka S, Yoshiike N and Shimomitsu T. 2011. Time trends for step-determined physical activity among Japanese adults. *Med Sci Sports Exerc* 43: 1913-1919. doi: 10.1249/MSS.0b013e31821a5225.
4) Sørensen K, Van den Broucke S, Fullam J, Doyle G, Pelikan J, Slonska Z and Brand H; (HLS-EU) Consortium Health Literacy Project European. 2012. Health literacy and public health: a systematic review and integration of definitions and models. *BMC Public Health* 12: 80. doi: 10.1186/1471-2458-12-80.
5) Berkman ND, Sheridan SL, Donahue KE, Halpern DJ and Crotty K. 2011. Low health literacy and health outcomes: an updated systematic review. *Ann Intern Med* 155: 97-107. doi: 10.7326/0003-4819-155-2-201107190-00005.
6) Nutbeam D. 2000. Health literacy as a public health goal: a challenge for contemporary health education and communication strategies into the 21st century. *Health Promot Int* 15: 259-267. doi: 10.1093/heapro/15.3.259.
7) Chinn D. 2011. Critical health literacy: a review and critical analysis. *Soc Sci Med* 73: 60-67. doi: 10.1016/j.socscimed.2011.04.004.
8) Ishikawa H and Yano E. 2008. Patient health literacy and participation in the health-care process. *Heal Expect* 11: 113-122. doi: 10.1111/j.1369-7625.2008.00497.x.
9) Heijmans M, Waverijn G, Rademakers J, van der Vaart R and Rijken M. 2015. Functional, communicative and critical health literacy of chronic disease patients and their importance for self-management. *Patient Educ Couns* 98: 41-48. doi: 10.1016/j.pec.2014.10.006.
10) Inoue M, Takahashi M and Kai I. 2013. Impact of communicative and critical health literacy on understanding of diabetes care and self-efficacy in diabetes management: a cross-sectional study of primary care in Japan. *BMC Fam Pract* 14: 40. doi: 10.1186/1471-2296-14-40.
11) Lai AY, Ishikawa H, Kiuchi T, Mooppil N and Griva K. 2013. Communicative and critical health literacy, and self-management behaviors in end-stage renal disease patients with diabetes on hemodialysis. *Patient Educ Couns* 91: 221-227. doi: 10.1016/j.pec.2012.12.018.
12) Furuya Y, Kondo N, Yamagata Z and Hashimoto H. 2015. Health literacy, socioeconomic status and self-rated health in Japan. *Health Promot Int* 30: 505-513. doi: 10.1093/heapro/dat071.
13) Adams RJ, Piantadosi C, Ettridge K, Miller C, Wilson C, Tucker G and Hill CL. 2013. Functional health literacy mediates the relationship between socio-economic status, perceptions and lifestyle behaviors related to cancer risk in an

Australian population. *Patient Educ Couns* 91: 206-212. doi: 10.1016/j.pec.2012.12.001.

14) Chang LC. 2011. Health literacy, self-reported status and health promoting behaviors for adolescents in Taiwan. *J Clin Nurs* 20: 190-196. doi: 10.1111/j.1365-2702.2009.03181.x.
15) Dominick GM, Dunsiger SI, Pekmezi DW and Marcus BH. 2013. Health literacy predicts change in physical activity self-efficacy among sedentary Latinas. *J Immigr Minor Health* 15: 533-539. doi: 10.1007/s10903-012-9666-7.
16) Ishikawa H, Nomura K, Sato M and Yano E. 2008. Developing a measure of communicative and critical health literacy: a pilot study of Japanese office workers. *Health Promot Int* 23: 269-274. doi: 10.1093/heapro/dan017.
17) Osborn CY, Paasche-Orlow MK, Bailey SC and Wolf MS. 2011. The mechanisms linking health literacy to behavior and health status. *Am J Health Behav* 35: 118-128. doi: 10.5993/AJHB.35.1.11.
18) von Wagner C, Knight K, Steptoe A and Wardle J. 2007. Functional health literacy and health-promoting behavior in a national sample of British adults. *J Epidemiol Community Health* 61: 1086-1090. doi: 10.1136/jech.2006.053967.
19) Kruger J, Ham SA, Berrigan D and Ballard-Barbash R. 2008. Prevalence of transportation and leisure walking among U.S. adults. *Prev Med* 47: 329-334. doi: 016/j.ypmed.2008.02.018.
20) Shibata A, Oka K, Harada K, Nakamura Y and Muraoka I. 2009. Psychological, social, and environmental factors to meeting physical activity recommendations among Japanese adults. *Int J Behav Nutr Phys Act* 6: 60. doi: 10.1186/1479-5868-6-60.
21) Matsushita M, Harada K and Arao T. 2015. Socioeconomic position and work, travel, and recreation-related physical activity in Japanese adults: a cross-sectional study. *BMC Public Health* 15: 916. doi: 10.1186/s12889-015-2226-z.
22) Ministry of Health Labour and Welfare. Comprehensive Survey of Living Conditions 2012. Available from: http://www.mhlw.go.jp/toukei/saikin/hw/k-tyosa/k-tyosa12/index.html. (*in* Japanese)
23) Ministry of Internal Affairs and Communications. Basic resident register 2013. Available from: http://www.soumu.go.jp/menu_news/s-news/01gyosei02_02000055.html. (*in* Japanese)
24) World Health Organization. Global physical activity surveillance. Available from: http://www.who.int/chp/steps/GPAQ/en/%5Cnhttp://files/1012/en.html.
25) Bull FC, Maslin TS and Armstrong T. 2009. Global physical activity questionnaire (GPAQ): nine country reliability and validity study. *J Phys Act Health* 6: 790-804. doi: 10.1123/jpah.6.6.790.
26) Cleland CL, Hunter RF, Kee F, Cupples ME, Sallis JF and Tully MA. 2014. Validity of the Global Physical Activity Questionnaire (GPAQ) in assessing levels and change in moderate-vigorous physical activity and sedentary behaviour. *BMC Public Health* 14: 1-11. doi: 10.1186/1471-2458-14-1255.
27) World health Organization. Global recommendations on physical activity for health. Available from: http://www.who.int/dietphysicalactivity/publications/9789241599979/en/.
28) Molina-García J, Castillo I and Sallis JF. 2010. Psychosocial and environmental correlates of active commuting for university students. *Prev Med* 51: 136-138. doi: 10.1016/j.ypmed.2010.05.009.