Health Promotion International, Vol. 29 No. 4
doi:10.1093/heapro/dat021
Advance Access published 10 April, 2013

Reliability and validity of a scale for health-promoting schools

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SUMMARY

Despite a growing body of research regarding the health-promoting schools (HPS) concept from the World Health Organization (WHO), research on measuring of the HPS is limited. This study aims to develop a scale for assessing the status of the HPS based on the WHO guidelines and to evaluate the reliability and validity of the scale. After completing the translation and back-translation process, the content validity of the 50-item scale for HPS (SHPS) was assessed by an expert committee review and pretested with 17 teachers. A stratified, random sampling design was used. A total of 728 teachers from 94 schools completed a self-administered questionnaire. The total sample was randomly divided into three groups for exploratory factor analysis (EFA), confirmatory factor analysis (CFA) and cross-validation. The EFA suggested seven factors, including 37 items, and the CFA confirmed these factors. In a second-order factor analysis, the second-order seven-factor model had acceptable fit indices (root mean square error of approximation 0.07, comparative fit index 0.98) with stability over validation sample and whole sample. Thus, the first-order seven factors (school nutrition services [three-item, $\alpha = 0.87$], healthy school policies [six-item, $\alpha = 0.87$], school's physical environment [10-item, $\alpha = 0.91$], school's social environment [four-item, $\alpha = 0.88$], community links [six-item, $\alpha = 0.91$], individual health skills and action competencies [three-item, $\alpha = 0.89$], and health services [five-item, $\alpha = 0.86$]) loaded significantly onto the second-order factor (HPS [37-item, $\alpha = 0.97$]). In conclusion, the SHPS is a reliable and valid measurement tool for assessing the states of the HPS in the Korean school context. It will be useful for comprehensively assessing schools' needs and monitoring the progress of school health interventions.

Key words: health-promoting school; reliability; validity; measurement

INTRODUCTION

The health-promoting schools (HPS) concept from the World Health Organization (WHO) is a comprehensive approach to school health promotion in which broad health education curriculum is supported by the environment and ethos of the school as well as the link with the greater community (Mukoma and Flisher, 2004; Lee *et al.*, 2005; Young, 2005; Buijs and Bowker, 2010). The HPS was effective in changing student health and health-related behaviors, improving learning environments and student achievement, and engaging local community and parents in partnership (Stewart-Brown, 2006; Leger *et al.*, 2007; Warwick *et al.*, 2009). In Korea, such a comprehensive approach based on the HPS has been adopted since 2005 and is expanding nationwide.

While the potential of the HPS is widely recognized, the evaluation for the HPS is still a major topic of discussion. HPS evaluation is a

complex and multifactorial concept as it involves activity in more than one domain: curriculum, school environment and community (Mukoma and Flisher, 2004; Lee *et al.*, 2005; Leger *et al.*, 2007; Pommier *et al.*, 2010). School health promotion has names other than the HPS from the WHO, such as the coordinated school health program (CSHP) from the U.S. Centers for Disease Control and Prevention (CDC), and the focusing resources on effective school health (FRESH) from the United Nations Educational Scientific and Cultural Organization (UNESCO). Irrespective of the name, the comprehensive and integrated approaches to health promotion in schools embody the same core components of policy, skills-based health education, services and a healthy environment (Deschesnes *et al.*, 2003; Whitman and Aldinger, 2009).

Instruments to evaluate school health promotion have been developed based on the core components. The school health index (SHI) based on the CSHP model was developed to identify the strengths and weaknesses of school's policies and programs for promoting health and safety (Butler *et al.*, 2011). The SHI consists of eight components: health education, physical education, nutrition services, health services, counseling psychological and social services, health promotion for staff, family and community involvement, and health and safety policies and environment (Center for Disease Control and Prevention, 2012). At a later date, in 1996, the WHO listed six essential components that comprise the guidelines for the HPS: healthy school policies, the school's physical environment, the school's social environment, community links, individual health skills and action competencies, and health services (Deschesnes *et al.*, 2003; Leger *et al.*, 2010). Based on the six essential components of the HPS, the Hong Kong Healthy Schools Award was launched, and an instrument to assess the schools' health profile was developed (Lee *et al.*, 2007). Additionally, a comprehensive school health checklist was developed to evaluate HPS status in developing countries (Yoshimura *et al.*, 2009). To assess state elementary schools in Australia, the HPS audit checklist was developed with 40 items clustered into six components. This 40-item scale measures health policies, physical environment, social environment, school–community relations and personal skill-building, using a five-point Likert scale. The HPS audit has demonstrated internal consistency with an overall reliability coefficient of 0.88 (Lemerle, 2005).

In terms of the scale to evaluate the HPS, previous studies do not provide a sufficient guarantee of validity and reliability. Particularly, research on the construct validity is limited. The construct validity is directly concerned with consistency between an underlying factor structure of instrument and a thoughtful conceptual definition (Levine, 2005; Devellis, 2012). To understand how many factors underlie a set of items, factor analysis is a useful analytic tool (Devellis, 2012). Although the construct validity of HPS audit checklist was assessed by using factor analysis, the results did not provide consistent factor structures (Lemerle, 2005; Sun and Stewart, 2007).

Evaluations based on the six HPS components contribute to comprehensively assessing the schools' needs and monitoring the progress of school health interventions. Thus, this study aims to develop a scale for the HPS based on guidelines for HPSs developed by the WHO in 1995 and to assess the reliability and validity of the scale.

METHODS

Participants and data collection

To assess the reliability and validity of the scale, a stratified, random sample design was used. A total of 125 elementary, middle and high schools in the Seoul and Gyeonggi areas were randomly selected. Principals, vice principals, health teachers, physical education teachers, classroom teachers, nutritionists and school counselors at each school were recruited to participate in the study. Survey data were collected from June to August 2010. A total of 1251 self-administered questionnaires with written instructions accompanied by stamped addressed envelopes were sent to each school address. Out of 125 schools, 94 of the schools (75%) answered all questions. A total of 728 teachers participated in the survey. The overall response rate was 58.2%. The response rates according to professionals were as follows: principals and vice principals (28.8%), health teachers (65.6%), physical education teachers and classroom teachers (64.6%), nutritionists and school counselors (43.2%). Based on the recommendation that the sample size for the factor analysis should be five times

the number of items (Bentler and Chou, 1987; Devellis, 2012), the overall sample size of this study was adequate.

Measurement

Development of the scale for health-promoting schools (SHPS) was based on the regional guidelines on development of HPS: a framework for action (WHO, 1996). To develop items for the scale, components and checkpoints from the HPS proposed by the regional guidelines were translated from English to Korean by the first author. The Korean version of the items was then back-translated into English by three bilingual Koreans. Comparison of the original English with the back-translated English revealed no important differences. Based on the Korean school environment, policies on the control of parasites, sun protection and HIV/AIDS of healthy school policies were deleted, and the feasibility of each item was reviewed by the authors. An expert committee, composed of six members with diverse academic backgrounds (school health, psychology, nutrition and education), assessed the content validity. Pretesting was conducted with 17 teachers.

The SHPS consisted of six components with 50 items. Healthy school policies were measured using a 15-item test and included questions about school policies regarding healthy food, smoke-free grounds, medication and health screening, first aid equipment, and the school's referral system. Each school's physical environment was measured using a 13-item test that included questions about buildings, grounds and equipment in the schools. Each school's social environment was measured using a five-item test and included questions about the quality of the relationships among staff, students and parents. Community links were measured by a six-item test and included questions about connections among the school, the students' families and the local community. Individual health skills and action competencies were measured using a six-item test and included questions about formal and informal curriculum for health education. Health service was measured by a five-item test that included questions about the school's health services for students and teachers. Four response options were given in the form of a four-point Likert scale: (i) not at all, (ii) a little, (iii) quite a lot and (iv) very much. Scores ranged from 1 to 4, with a higher score reflecting a higher quality of a HPS.

Ethical considerations

The Institutional Review Board of Hanyang Medical Center, Seoul, Korea approved this study prior to data collection. The participants were informed about the purpose of the research and were assured of the right to refuse to participate or to withdraw from the study at any stage. Anonymity and confidentiality were guaranteed.

Data analysis

The total sample was randomly divided into three groups: sample for exploratory factor analysis (EFA) ($n = 242$), calibration sample for confirmatory factor analysis (CFA) ($n = 243$) and validation sample for CFA ($n = 243$). There were no significant differences in the mean SHPS scores and demographic variables among the three groups. To evaluate the construct validity, EFA and CFA were performed using the comprehensive exploratory factor analysis (CEFA) version 3.04 (Browne *et al.*, 2010) and the linear structural relationship (LISREL) version 8.52 (Jöreskog and Sörbom, 2001), respectively. After assessing normality and internal consistency of items, the EFA was conducted to determine the factor structure of the scale. The common factor model estimated by the maximum-likelihood (ML) method was used, and oblique rotation was conducted. To evaluate the results from the EFA, the CFA was conducted on the data from the calibration sample ($n = 243$) using the ML method. A second-order factor analysis was then conducted to investigate whether the first-order factors from the EFA, which were confirmed by CFA, were valid aspects for the overall theme of a HPS. To assess the cross-validation, a validation sample ($n = 243$) was used to confirm the model. The model was considered to have a close fit and to be parsimonious for the following reasons: (i) chi-squared test was not significant, (ii) the standardized root mean square residuals (SRMR) were ≤ 0.08, (iii) the root mean square error of approximation (RMSEA) was ≤ 0.06 and (iv) the comparative fit index (CFI) was ≥ 0.95 (Hu and Bentler, 1998, 1999; Leoehlin, 2004). To evaluate the reliability, the internal consistency of the scale was tested using Chronbach's alpha. To assess the resulting factor structure, descriptive statistics were calculated. The data from the

whole sample was analyzed ($n = 486$) using PASW Statistics 18.0 (SPSS Inc, Chicago, IL, USA).

RESULTS

A total of 728 teachers from 94 elementary, middle and high schools participated. The majority of the participants were women (68.5%). The mean age was 44.2 years (SD = 9.4, range = 23–68). The mean length of teaching experience was 18.7 years (SD = 10.3, range = 0.1–41). Most respondents were general teachers (69.9%), including physical education teachers, whereas the remaining were health teachers (11.8%), principals or vice principals (10.4%) and others (7.8%). The majority of the participants worked in public schools (84.8%), 40.0% were in elementary schools and 51.2% of the schools were in the Gyeonggi Province. Based on the information from the Education offices, this sample represented the population well.

Exploratory factor analysis

Kurtosis and skewness were calculated for each item in order to assess normality. Kurtosis of all items was less than 1.7, and skewness was less than 1.0. All items showed acceptable kurtosis and skewness statistics. A score for corrected item to total correlation (CITC) was calculated for each item to assess the item's reliability. CITC values of all items were greater than 0.40, indicating acceptable items for the EFA. Thus, no item was removed for the factor analysis.

The EFA sample ($n = 242$) was used to carry out the EFA, which helped identify a number of latent factors. Although the SHPS was designed as a six-factor model, results from the EFA suggested that a seven-factor model was the best, using the Kaiser criterion (eigenvalue > 1) and RMSEA (≤ 0.6). Items with factor loading greater than 0.4 were included. A total of 37 items were retained for the CFA. Table 1 shows the rotated factor pattern loadings. Labels for the seven factors were as follows: school nutrition services, healthy school policies, the school's physical environment, the school's social environment, community links, individual health skills and action competencies, and health services.

Confirmatory factor analysis

To evaluate the EFA results, the CFA was performed with the calibration sample ($n = 243$). The seven-factor model from the EFA showed acceptable fit statistics: $\chi^2 = 1287.21$ (df = 608, $p < 0.001$), SRMR = 0.06, RMSEA = 0.07 and CFI = 0.98. The second-order factor analysis was conducted to test whether the hypothesized second-order factor (HPS) actually accounted for the pattern of relations between the first-order factors (school nutrition services, healthy school policies, school's physical environment, school's social environment, community links, individual health skills and action competencies, and health services). The second-order seven-factor model displayed acceptable fit statistics: $\chi^2 = 1385.93$ (df = 622, $p < 0.001$), SRMR = 0.06, RMSEA = 0.07 and CFI = 0.98. Table 2 shows that the seven first-order factors loaded significantly onto the second-order factor (HPS), and factor loadings (γ) ranged from 0.75 to 0.90. Additionally, all items loaded significantly onto the first-order factor and had factor loadings (λ) from 0.57 to 0.88.

To assess the cross-validation for the factor structure of the scale, second-order factor analysis was conducted for the validation sample ($n = 243$). The fit statistics for the validation sample indicated an acceptable fit between the data and the theoretical model: $\chi^2 = 1393.40$ (df = 622, $p < 0.001$), SRMR = 0.07, RMSEA = 0.07 and CFI = 0.97. The pattern and size of loadings (γ, λ) were similar to those in the calibration sample. All items in the scale had factor loadings in excess of 0.60 (Table 2). The results from the second-order factor analysis for the whole sample ($n = 486$) are displayed in Table 2. The fit statistics for the whole sample were acceptable: $\chi^2 = 1969.52$ (df = 622, $p < 0.001$), SRMR = 0.06, RMSEA = 0.07 and CFI = 0.98.

In summary, these results supported the second-order seven-factor model as the factor structure of the SHPS. Also, generalization of the model was supported through cross-validation, using the validation sample and the whole sample.

Reliability and descriptive statistics

As shown in Table 3, Cronbach's alpha coefficient was 0.97 for the 37 items. Cronbach's alpha coefficient for the seven factors ranged from 0.86 to 0.91.

Table 1: Factor loadings for the seven extracted factors from exploratory factor analysis

Item	F1	F2	F3	F4	F5	F6	F7
School nutrition services							
P_1. Hygiene management of school lunch is enforced.	0.07	0.10	0.07	−0.05	**0.82**	0.09	−0.09
P_2. Nutritionally balanced lunch is provided in school.	0.01	0.12	0.00	0.03	**0.71**	0.04	0.09
P_3. Teachers act as role models by eating healthy foods at school.	0.13	−0.07	−0.01	0.09	**0.64**	−0.01	0.26
Healthy school policies							
p_4. No smoking in school buildings is enforced.	0.18	0.16	0.07	0.25	0.32	−0.12	0.05
P_5. Smoking-cessation program is provided for teachers.	0.16	0.10	0.22	0.36	0.11	−0.14	0.20
P_6. Smoking-cessation program is provided for students.	−0.02	0.03	0.27	**0.42**	0.25	0.02	0.09
P_7. Health assessment and medication administration records are kept by the school.	−0.08	−0.04	0.11	**0.52**	0.25	0.22	0.12
P_8. There are adequate first aid kits for the school population.	−0.08	0.01	0.03	**0.42**	0.20	0.21	0.18
P_9. Teachers are offered first aid training.	0.24	0.08	0.14	**0.43**	−0.25	0.15	0.03
P_10. Students are offered first aid training.	0.19	0.10	0.27	0.36	−0.08	0.04	0.02
P_11. The school has a referral system for emergency cases.	0.21	0.28	−0.10	**0.45**	0.10	−0.04	0.07
P_12. Parents are informed about screening results of their children.	−0.01	0.09	0.08	**0.42**	0.16	0.22	0.08
P_13. Teachers discuss health problems of students with parents.	0.37	0.20	−0.03	0.25	0.15	0.14	−0.10
P_14. The school has shortened school hours when students' health is damaged by epidemic outbreak, extreme heat, or cold.	0.22	0.29	−0.17	0.15	0.17	0.12	0.19
P_15. The school has an evacuation plan for fires or disaster.	0.17	0.35	−0.05	0.18	0.08	−0.07	0.34
School's physical environment							
PE_1. The school undertakes periodic safety audits of all buildings, plants, and equipment to ensure they are safe.	−0.03	0.37	0.15	−0.04	0.02	0.05	0.44
PE_2. In conjunction with the local community, the school takes action to prevent local traffic accidents.	0.09	0.12	0.11	0.02	0.05	0.07	0.43
PE_3. Proper facilities for disabled students are provided.	−0.01	0.28	0.27	−0.12	0.03	0.17	0.22
PE_4. Safe and clean water is available for drinking.	0.03	**0.46**	0.08	−0.05	0.31	0.03	0.17
PE_5. There are sufficient and clean toilets for students.	0.11	**0.51**	0.20	0.07	0.18	−0.12	0.01
PE_6. Recycling of renewable resources, such as paper, glass, and aluminum, is undertaken.	0.07	**0.51**	0.14	0.01	0.27	0.02	0.01
PE_7. Students participate in keeping the school clean.	0.08	**0.51**	0.27	−0.07	0.06	−0.06	0.12
PE_8. Adequate ventilation exists in all school areas.	0.10	**0.48**	0.21	0.03	0.06	0.07	0.10
PE_9. The lighting is adequate in each classroom.	−0.05	**0.57**	0.10	0.03	0.16	0.09	0.01
PE_10. Heating and cooling are available when needed.	0.12	**0.58**	−0.15	0.07	−0.04	0.33	−0.09
PE_11. Double windows are installed in classrooms and corridors.	−0.06	**0.58**	−0.02	0.02	0.06	0.16	0.06
PE_12. Auxiliary lamps for blackboards are installed.	−0.01	**0.43**	−0.13	0.15	−0.06	−0.07	0.23
PE_13. Furniture and other facilities cater to different sizes of students.	−0.06	**0.51**	0.04	0.04	0.24	0.16	0.05
School's social environment							
SE_1. Students are encouraged to be active participants in the learning process.	0.00	0.22	−0.03	0.01	0.20	0.16	**0.50**
SE_2 Teachers do not use harsh discipline, including physical or verbal abuse.	−0.01	0.07	0.00	−0.03	0.11	0.10	**0.70**
SE_3. The school actively discourages physical and verbal violence among students.	0.18	−0.06	−0.02	0.01	0.02	0.06	**0.63**
SE_4. The school has health-related events.	0.30	−0.06	0.17	0.12	−0.02	−0.08	0.38
SE_5. The school helps parents to have positive attitudes about student abilities.	0.18	0.00	0.10	0.12	0.01	0.04	**0.56**
Community links							
C_1. Families are involved in making decisions about suitable health-promoting activities.	**0.65**	−0.03	−0.05	−0.04	0.17	0.13	0.14
C_2. The school offers health-related activities which involve children working with their families.	**0.74**	−0.05	−0.04	0.12	0.03	−0.01	0.01
C_3. Local groups with an interest in child and adolescent health and community health organizations participate collaboratively in school activities.	**0.57**	0.00	−0.09	0.10	0.12	0.08	0.18
C_4. Students and teachers participate in local events on a regular basis.	**0.77**	−0.04	0.06	−0.03	−0.01	−0.01	0.10

Continued

Table 1: *Continued*

Item	F1	F2	F3	F4	F5	F6	F7
C_5. The school informs the local community of its health initiatives.	**0.78**	0.04	0.00	−0.07	0.04	0.06	0.01
C_6. The school offers health-related activities for the local community.	**0.65**	0.05	0.16	−0.01	−0.06	−0.04	0.05
Individual health skills and action competencies							
PS_1. The health curriculum is designed to be interesting, engaging and relevant to students, and localized where relevant.	0.43	0.10	0.26	0.08	−0.09	0.18	0.05
PS_2. Health education content consists of one's daily healthy behavior management (skills).	0.27	0.05	**0.41**	0.11	0.06	0.21	−0.01
PS_3. Sufficient time per week is allocated to health in the overall curriculum.	0.47	0.06	0.34	−0.14	0.06	0.08	0.08
PS_4. Students have opportunities to gain skills with respect to specific and relevant health issues (e.g., resistance to tobacco).	0.12	0.04	**0.65**	0.09	0.14	0.10	0.02
PS_5. Students gain competencies to enhance their own health and well-being.	0.02	0.00	**0.67**	0.15	0.06	0.13	0.13
PS_6. Teachers are supported by receiving adequate information about the availability and use of health resources.	0.36	0.04	0.30	0.31	0.06	0.06	−0.03
Health services							
HS_1. Appropriate immunizations are provided.	0.25	0.04	0.04	−0.18	0.02	**0.50**	0.12
HS_2. Appropriate health screening is provided.	−0.10	0.11	0.02	0.23	0.21	**0.59**	0.03
HS_3. Appropriate basic oral health services are provided	0.12	0.04	0.12	0.00	0.08	**0.52**	0.15
HS_4. Counseling and support services are available for socially and emotionally distressed students and those with medical problems.	0.04	0.03	0.14	0.18	0.07	**0.50**	0.15
HS_5. Health teachers provide training programs for teachers in appropriate topics (e.g., physical assessment, hypertension management, and first aid).	0.09	0.08	0.18	0.28	−0.07	**0.45**	0.02

Bold items were selected by the EFA.

To assess correlation among factors, a Pearson correlation analysis was conducted. Correlation coefficients among factors ranged from 0.47 to 0.76. The mean scores of each of the factors ranged from 3.35 (SD = 0.49) to 2.82 (SD = 0.57). While school nutrition services showed the highest mean score, the mean score for community links had the lowest ranking score. Additionally, there were significant differences in the mean SHPS scores among elementary, middle and high schools ($p < 0.001$): elementary school (mean = 3.40, SD = 0.41), middle school (mean = 3.13 SD = 0.39) and high school (mean = 2.99, SD = 0.34).

DISCUSSION

Based on the WHO guidelines, the SHPS was developed to comprehensively assess the status of HPS at the school level. EFA and CFA of the SHPS revealed 37 items grouped into seven latent factors: school nutrition services, healthy school policies, school's physical environment, school's social environment, community links, individual health skills and action competencies, and health services. The second-order seven-factor model was identified as a factor structure of the SHPS through CFA and was supported by findings from cross-validation. Thus, the seven first-order factors loaded significantly onto the second-order factor (HPS). Internal consistency of each of the factors was quite high, ranging from 0.86 to 0.91, and the reliability of the total instrument was 0.97.

The SHPS may be considered as highly reliable scale. The Cronbach's alpha for the seven factors ranged from 0.86 to 0.91. These were within the 'good' range greater than 0.80, as suggested by DeVellis (2012).

The construct validity of the SHPS was supported by a second-order seven-factor model with acceptable goodness-of-fit indices. All second-orders loadings (γ) were high, ranging from 0.75 to 0.90, and all first-order loadings (λ) were also high, ranging from 0.57 to 0.88. Additionally, all items loaded significantly onto the hypothesized first-order factor (convergent validity) and at the same time did not loaded significantly onto any other first-order factor (discriminant validity; Hochwalder and Brucefors, 2005).

Table 2: Factor loadings of the second-order seven-factor model for the calibration and validation samples

Item name		Latent variable	Calibration sample ($n = 243$)		Validation sample ($n = 243$)		Whole sample ($n = 486$)	
			γ/λ	SMC	γ/λ	SMC	γ/λ	SMC
Factor 1	←	HPS	0.77	0.60	0.78	0.61	0.78	0.61
Factor 2	←	HPS	0.89	0.80	0.89	0.80	0.89	0.80
Factor 3	←	HPS	0.86	0.75	0.86	0.74	0.86	0.74
Factor 4	←	HPS	0.90	0.80	0.90	0.81	0.90	0.81
Factor 5	←	HPS	0.75	0.56	0.75	0.56	0.75	0.56
Factor 6	←	HPS	0.76	0.57	0.76	0.57	0.76	0.57
Factor 7	←	HPS	0.89	0.80	0.86	0.75	0.88	0.78
P_1	←	Factor 1	0.80	0.64	0.90	0.81	0.85	0.72
P_2	←	Factor 1	0.86	0.75	0.86	0.75	0.88	0.75
P_3	←	Factor 1	0.78	0.61	0.77	0.59	0.77	0.60
P_6	←	Factor 2	0.76	0.58	0.74	0.54	0.75	0.57
P_7	←	Factor 2	0.81	0.66	0.69	0.48	0.75	0.56
P_8	←	Factor 2	0.78	0.61	0.75	0.57	0.76	0.57
P_9	←	Factor 2	0.64	0.41	0.60	0.36	0.62	0.39
P_11	←	Factor 2	0.72	0.52	0.79	0.62	0.75	0.57
P_12	←	Factor 2	0.76	0.58	0.76	0.58	0.77	0.59
PE_4	←	Factor 3	0.68	0.46	0.74	0.55	0.71	0.50
PE_5	←	Factor 3	0.75	0.56	0.78	0.60	0.77	0.59
PE_6	←	Factor 3	0.78	0.61	0.78	0.61	0.78	0.61
PE_7	←	Factor 3	0.69	0.48	0.73	0.53	0.71	0.51
PE_8	←	Factor 3	0.80	0.64	0.80	0.64	0.80	0.65
PE_9	←	Factor 3	0.81	0.66	0.73	0.53	0.77	0.59
PE_10	←	Factor 3	0.72	0.51	0.73	0.53	0.72	0.52
PE_11	←	Factor 3	0.60	0.36	0.73	0.53	0.66	0.43
PE_12	←	Factor 3	0.57	0.32	0.60	0.36	0.58	0.34
PE_13	←	Factor 3	0.69	0.47	0.66	0.44	0.68	0.46
SE_1	←	Factor 4	0.84	0.70	0.82	0.67	0.83	0.69
SE_2	←	Factor 4	0.81	0.66	0.80	0.64	0.80	0.65
SE_3	←	Factor 4	0.76	0.57	0.79	0.62	0.77	0.59
SE_5	←	Factor 4	0.83	0.70	0.80	0.64	0.82	0.67
C_1	←	Factor 5	0.80	0.64	0.71	0.51	0.76	0.57
C_2	←	Factor 5	0.87	0.76	0.77	0.59	0.82	0.68
C_3	←	Factor 5	0.81	0.65	0.72	0.52	0.77	0.59
C_4	←	Factor 5	0.83	0.69	0.76	0.58	0.80	0.64
C_5	←	Factor 5	0.88	0.78	0.83	0.69	0.86	0.74
C_6	←	Factor 5	0.81	0.66	0.81	0.65	0.81	0.65
PS_2	←	Factor 6	0.77	0.59	0.75	0.56	0.76	0.57
PS_4	←	Factor 6	0.87	0.76	0.91	0.83	0.89	0.80
PS_5	←	Factor 6	0.93	0.87	0.95	0.90	0.94	0.88
HS_1	←	Factor 7	0.59	0.35	0.69	0.48	0.64	0.42
HS_2	←	Factor 7	0.78	0.60	0.82	0.68	0.80	0.64
HS_3	←	Factor 7	0.69	0.48	0.80	0.64	0.75	0.56
HS_4	←	Factor 7	0.87	0.76	0.80	0.64	0.84	0.70
HS_5	←	Factor 7	0.77	0.60	0.69	0.47	0.73	0.53

HPS, health-promoting school; factor 1, school nutrition services; factor 2, healthy school policies; factor 3, school's physical environment; factor 4, school's social environment; factor 5, community links; factor 6, individual health skills and action competencies; factor 7, health services. SMC, squared multiple correlations.

This study showed that, contrary to expectations, a seven-factor model was optimal. Three items from healthy school policies loaded onto the school nutrition services factor. These results are not in line with previous studies. Lemerle reported a four factor model for the HPS audit (Lemerle, 2005). Later, CFA of the HPS audit revealed 32 items grouped into six latent factors (df = 458, RMSEA = 0.06, CFI = 0.98) and all items had factor loadings from 0.56 to 0.87 (Sun and Stewart, 2007). Possible reasons for our result are as follows. Based on the School Meal Act in 1981, the National School Lunch program in Korea has been

Table 3: Reliability and descriptive statistics for the whole sample ($n = 486$)

Latent variable	Number of items	Mean (SD)	HPS	1	2	3	4	5	6	7
Health-Promoting Schools (HPS)	37	3.20 (0.42)	0.97							
1. School nutrition services	3	3.35 (0.49)	0.644	0.87						
2. Healthy school policies	6	3.28 (0.48)	0.688	0.654	0.87					
3. School's physical environment	10	3.25 (0.48)	0.718	0.657	0.677	0.91				
4. School's social environment	4	3.18 (0.53)	0.762	0.610	.0645	0.731	0.88			
5. Community links	6	2.82 (0.57)	0.707	0.471	0.614	0.527	0.673	0.91		
6. Individual health skills and action competencies	3	3.11 (0.55)	0.637	0.498	0.654	0.552	0.603	0.662	0.89	
7. Health services	5	3.33 (0.50)	0.656	0.587	0.688	0.627	0.661	0.589	0.640	0.86

The lower triangle shows correlations; all correlations are significant at $p < 0.001$. The diagonal line in closed boxes shows reliability.

implemented in elementary, middle and high schools since 1998, and the participating student rate in the programs was 95.5% at the end of December 2006 (Kwak and Chang, 2008). Recently, free school lunch programs have been started in Seoul and the Gyeonggi area. School nutrition services in Korea are an important part of health promotion in schools. The school lunch program has a long history, and most students participate in this service. Findings from this study reflect the realities of Korean schools.

The results from this study revealed that all schools had a weakness at the community links, and middle and high schools were challenged places regarding implementation of the HPS. These results are in line with previous studies (Adamson *et al.*, 2006; Lee *et al.*, 2007; Lee *et al.*, 2009). Moreover, the SHI from U.S. CDC enables school to assess their health education, safety policies and related programs and to develop action plans at school (Butler *et al.*, 2011). Thus, the SHPS may be used practically for needs assessment and for developing strategies to improve school health in all school level as well as national level. Additionally, the school-balanced scorecard is a strategic management instrument to create HPS through integration of health management in schools (Liersch *et al.*, 2012).

There are several limitations to the present study. First, the original research sample was divided randomly into three subsamples to assess the construct validation of the scale. Thus, these three subsamples were not truly independent samples. In future studies, findings from this study should be validated with independent samples. Second, although the SHPS was developed based on WHO guidelines, the reliability and validity of the scale were assessed in the Korean school context. Therefore, refinement and evaluation of the scale across international school contexts is needed. Third, this study focused on the reliability and construct validity of the SHPS. In future studies, additional concurrent validity analysis is needed before the scale is used extensively. Despite the limitations mentioned above, it is important that this study suggest a reliable and valid scale for evaluating the statues of HPS at the school level based on the WHO guidelines. To the best of our knowledge, this is the first study aimed at assessing the reliability and construct validity of the scale using rigorous analysis methods, such as CEFA, and assessing cross-validation.

In conclusion, the utility of this study lies in its establishment of the reliability and validity of the SHPS. This study yielded evidence that the SHPS can be a useful scale to measure the status of HPS in the school context of Korea. In the future, the SHPS will be useful in comprehensively assessing the needs of schools and monitoring the progress of school health intervention. This scale will contribute to expansion of knowledge for health promotion in school settings in both research and practice.

FUNDING

This work was supported by the Health Promotion Fund, Ministry for Health and Welfare, Republic of Korea (10-38).

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