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Evaluation of a health-promoting school program to enhance correct medication use in Taiwan



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ABSTRACT

This study was an evaluation of the Health Promoting School (HPS) program in Taiwan and its effectiveness in enhancing students' knowledge and abilities with regard to correct medication usage. In 2011, baseline and follow-up self-administered online surveys were received from 3520 middle-school and primary students from intervention schools, and 3738 students from comparison primary and secondary schools completed the same survey. The results indicated that after implementing the correct medication use HPS program, students' knowledge and abilities concerning correct medication usage (i.e., the need to express clearly personal conditions to physicians, to check information on the medication packages, to take medication correctly and adhere to prescribed medication regimens, not to buy or acquire medication from unlicensed sources, and to consult pharmacists/physicians) were significantly increased among the students in the intervention schools ($p < 0.001$). In addition, students' knowledge and abilities concerning correct medication usage were significantly higher in the intervention schools compared with the comparison schools ($p < 0.001$). In conclusion, the correct medication use HPS program significantly enhanced students' knowledge and abilities concerning correct medication usage.

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1. Introduction

The World Health Organization (WHO) emphasizes that unintended, harmful reactions to medication are among the leading causes of death in many countries [1]. In addition, several problems have been identified with children and adolescents and their use of medication – unlicensed drugs,

counterfeit drugs, herbal medications that are not evidence-based, drugs from illicit street vendors, and the abuse of non-medical prescription drugs [2–4]. In the USA, about 10% of adolescents have reported the use of non-prescription pain relievers [5]. In Taiwan, 10% of adolescents have reported buying non-prescription pain relievers during the past year [6].

In 1995, Taiwan initiated a National Health Insurance program, which amounts to universal health insurance. Taiwan residents can access comprehensive treatments and obtain many drugs from different health sectors. Pharmaceuticals accounted for 24% of the total National Health expenditure in Taiwan in 2011 [7]. The average yearly number of outpatient visits in Taiwan (15.2 visits) was more than twice that (6.3 visits) in countries associated with the Organization for Economic Co-operation and Development (OECD) [8]. In Taiwan, some people engaged in “doctor-shopping” behavior that was more likely to result in duplicate medications that caused adverse drug reactions. A study in Taiwan showed associations between the duration of polypharmaceutical use and acute renal failure [9].

In Taiwan, problems have been documented concerning the use of medications: a lack of knowledge, attitudes, and practices regarding the safe use of medications [10]; co-medication that mixes conventional medication with non-prescribed Chinese herbal medication [11]; failure to comply with prescribed antibiotic regimens [12]; and purchasing medication from underground radio stations, street vendors, and tour buses. Studies have associated the use of non-prescribed Chinese herbal medication with chronic kidney disease [13] and end-stage renal disease [14].

During the past decade, the Taiwan government has trained pharmacists to teach people at community universities about safe medication use and found that enhancing participants’ medication knowledge can have a positive effect [15]. To expand safe medication use education to children and adolescents, the correct medication use HPS program was launched in 2009 by the Taiwan Food and Drug Administration in cooperation with the Taiwan Ministry of Education and Taiwan Pharmacist Association. Local schools and hospitals received a grant to work together to enhance teachers’ capacities to implement correct medication use education that enhances teacher and student competencies with regard to correct medication usage. The number of schools joining in the correct medication use HPS program increased from 51 schools in eight counties/cities in 2009 to 86 schools in 14 counties/cities in 2011, whereas the number of hospitals joining the correct medication use resource center program increased from 10 hospitals in eight counties/cities in 2009 to 18 hospitals in 15 counties/cities in 2011.

Promoting the health of children through schools has been an important goal of the WHO since 1950 [16]. The Health Promoting Schools (HPS) concept was based on the Ottawa Charter presented at the first international conference on health promotion in 1986 [17]. The WHO advocated HPS as an effective approach to promote the well-being of both school children and staff. The HPS concept was introduced in Taiwan in 2000. To facilitate adoption of the HPS program by schools, the Taiwan Ministry of Education funded local education authorities and universities to build HPS support networks to enhance teachers’ capacities to implement HPS programs.

HPS themes that were implemented included healthy weight, oral health, vision health, sex education, smoking prevention, and correct medication use.

Some studies have indicated that the implementation of the HPS program has had a positive impact on students’ health behaviors [18,19], on self-reports of health conditions [20], and on various domains of health for the school community [21]. However, no study has yet examined the effects of implementing correct medication use through the HPS program. This is the first attempt by the Taiwan government to develop materials that can be used to educate school-aged children about correct medication use in combination with HPS strategies. The aim of this study was to examine the effects of implementing the correct medication use portion of the HPS program in Taiwan. The hypothesis was that the implementation of a correct medication use program should have a positive effect by increasing students’ knowledge and abilities concerning correct medication usage.

In 2011, the correct medication use HPS program was implemented in 14 counties/cities in Taiwan. The program featured a collaborative partnership between schools, local education authorities, hospital/community pharmacists, and university support networks. At the national level, the Taiwan Food and Drug Administration cooperated with the Taiwan Ministry of Education, the Taiwan Pharmacist Association, and the Taiwan HPS support network to provide financial and expert resources to schools. At the local level, the city/county Education Bureau collaborated with the Health Bureau, the city/county pharmacist association, hospital correct medication use resource centers, and the city/county correct medication use school center to assist primary and secondary schools in adopting and implementing a correct medication use program. In addition, the city/county correct medication use school center cooperated with the pharmacist association and hospitals to provide teachers with training and to conduct city/county campaigns such as the correct medication use contest and the one school one pharmacist campaign. At the school level, schools invited hospital/community pharmacists and experts from the Taiwan HPS support network to build teacher capacity and to assist in the implementation of the correct medication use HPS program. More than 100 experts from different universities and hospitals were invited to participate in the correct medication HPS program support network in order to provide technical support for city/county officers and local schools.

To enhance teachers’ and students’ medication literacy, the core abilities of correct medication usage were developed [22]. The core abilities of correct medication usage were designed to be a national educational resource for schools and community groups in teaching students and families about correct medication use. The core abilities included the following five points: (1) Ability I, the ability to express clearly personal conditions to your physicians; (2) Ability II, the ability to check information on the medication packages; (3) Ability III, the ability to correctly take medications as prescribed; (4) Ability IV, the ability to be your own master in taking medications; and (5) Ability V, the ability to be in touch with your pharmacists and physicians. Teachers and pharmacists developed different kinds of teaching materials and activities based on the correct medication usage core abilities. Several

teaching materials and resources were reviewed and recruited into the correct medication education website to make it easy for schools to adopt and implement the correct medication use HPS program.

Schools implemented the correct medication HPS program based on the six components of the HPS guidelines including school health policies, personal health skills, physical environment of the school, social environment of the school, school health services, and community relations, which was set by the Western Pacific Region Office of WHO. Eighty-six schools joined the correct medication use HPS program in 2011. According to experts' evaluation, for school policy, two-thirds of the schools adopted the correct medication usage program as an important school project and added it into the annual schedule. For personal health skills, all schools integrated the five core abilities of correct medication usage into their health education curricula and/or other curricula. For the physical environment of schools, all schools displayed correct medication usage posters on health bulletins around the campus. With respect to school social environments, 75% of the schools held several activities such as a correct medication journalist campaign to encourage students to disseminate correct medication use information to their schools, families, and community members. For school health services, about half of the schools invited hospital/community pharmacists to provide medication consultation and teaching. With regard to community relationships, half of the schools cooperated with hospital/community pharmacists to implement a correct medication HPS program.

To examine the effectiveness of the correct medication use HPS program, the present study compared the results of the baseline and follow-up surveys of students' knowledge and abilities concerning correct medication usage in the intervention schools. In addition, we also compared the follow-up results between the intervention schools and the comparison schools.

2. Methods

2.1. Participants

The survey canvassed 3763 students in 45 intervention schools and 3738 students in 98 comparison schools. In 2011, there were 26 primary schools and 19 middle schools that implemented correct medication use HPS programs and completed the baseline and follow-up surveys in Taiwan. A total of 3763 students [5th/6th grade students ($n = 1951$) in primary school and 7th grade students ($n = 1812$) in middle school] completed the baseline survey in September 2011, whereas 3520 students completed the follow-up survey in November 2011. In addition, 56 primary schools and 42 middle schools that did not participate in a correct medication use HPS program were randomly selected. A total of 3738 students [5th/6th grade students ($n = 1995$) in primary school and 7th grade students ($n = 1743$) in middle school] completed the online survey in November 2011 for a response rate of 87%. The online self-administered questionnaire was anonymous. Students took the online survey in the computer room of their school.

2.2. Instruments

The self-administered questionnaire was based on a prior study [22] of five core abilities for correct medication usage. Experts were invited to assess the content validity of the questionnaire. In addition, a pretest survey was conducted to examine students' responses to the online survey and to evaluate the reliability of the data yielded by the questionnaire. The content validity index of the questionnaire was 0.91, whereas the Cronbach's α was 0.70 [22]. The dependent variables in the present study included students' knowledge and abilities with regard to correct medication usage.

2.3. Knowledge of correct medication usage

The measure of the students' knowledge of correct medication usage consisted of three components. The first component (Ability I) was the ability to express clearly personal conditions to physicians, which was measured using the answers to four items: "When you visit a physician, in addition to describing your illness, what else do you talk about?: (1) personal health history; (2) current medication and supplements use; (3) personal drug allergy conditions; and (4) examinations being given" The response options were limited to either yes (scoring 1) or no (scoring 0).

The second component referred to the checking of information on medication packages (Ability II), which was measured using the responses to five questions. Students were asked "When you pick up your medication after a physician visit, in addition to checking the name of the patient and directions for use, what other information should be checked on the medication label?: (1) medication indications; (2) appearance of the medication; (3) amount of the medication; (4) possible side effects and warnings for the medications; and (5) expiration date and proper storage for the medication" The response options were limited to either yes (scoring 1) or no (scoring 0).

The third component was how to buy or acquire medication (Ability IV), which was measured using the responses to nine questions. Students were asked "Is it correct to use the following methods to buy or to get medication?: (1) according to family/friends' recommendations; (2) TV advertisements; (3) radio advertisements; (4) through internet sales; (5) from parks or temple street vendor sales; (6) from traditional market sales; (7) from tour bus or rest area street vendor sales; (8) from overseas suppliers; and (9) according to traditional therapists' recommendations? The response options were limited to either correct (scoring 0) or incorrect (scoring 1). A higher mean score was equated with a higher level of knowledge.

2.4. Abilities of correct medication usage

Students' abilities to identify correct medication usage consisted of five components. The first component (Ability I), was to express clearly personal conditions to physicians, and this was measured using the responses to four questions: "When you visit a physician, in addition to describing your illness, do you clearly discuss your personal health history?; Do you clearly discuss your current medication and supplements

used?; Do you clearly discuss your drug allergies?; and Do you clearly discuss the exams you will be taking?” The response options were limited to either yes (scoring 1) or no (scoring 0). A higher mean score equated to a higher level of ability.

The second component, to check information on the medication packages (Ability II), was measured using the responses to five questions: “When you acquire your medication packages after a physician visit, in addition to checking the name of the patient and the use method, do you check the medication indications?; Do you check the appearance of the medications?; Do you check the total amount of the medications?; Do you check the possible side effects and the medication warnings?; and, Do you check the expiration date and the proper storage of the medications?” The response options were limited to either yes (scoring 1) or no (scoring 0).

The third component, to correctly take medications as prescribed (Ability III) was measured using the responses to three questions. The first was “Do you use the medications as prescribed?” The response options to the first question were limited to either “completely comply” (scoring 1) or “modify by self-based severity of illness” (scoring 0). The second and third questions were “If you feel better, do you stop taking your medication?” and “If you do not feel improvement after taking your medication, will you stop taking the medication?” The response options were limited to either yes (scoring 0) or no (scoring 1).

The fourth component was a question of self-control in taking medications (Ability IV), and this was measured using the responses to nine questions: “Will you buy or obtain medication according to: family/friends’ recommendations?; television advertisements?; radio advertisements?; internet sales?; park/temple street vendor sales?; traditional market sales?; tour bus or rest area street vendor sales?; overseas suppliers?; and traditional therapists’ recommendations?” The response options were limited to either yes (scoring 0) or no (scoring 1).

The fifth component, to notice and use the contact information of pharmacists and physicians (Ability V), was measured using the answers to three items: “Do you notice the consultation phone number printed on the medication package?; “Do you save the consultation phone numbers of your pharmacists?; and, “Do you call the consultation hotline printed on medication packages when you have questions about your prescribed medications?” The response options were limited to either yes (scoring 1) or no (scoring 0).

The independent variable in this study was sex (female vs. male) and school grade (5th, 6th, or 7th grade).

2.5. Data analysis

SAS software (SAS Institute, Cary, NC, USA) was used to perform the statistical analysis. Percentages and means were calculated for all variables. For the intervention group, we compared the mean score of students’ knowledge and abilities concerning correct medication usage prior to and after the correct medication use HPS program, and used the *t* test to determine if there was a statistically significant difference in the mean score between the baseline and follow-up surveys. In addition, a *t* test was performed to establish the differences

in students’ knowledge and abilities concerning correct medication usage between the intervention and comparison groups. Statistical significance was determined to be $p < 0.05$.

3. Results

3.1. Change in students’ abilities in the intervention group

The Taiwan correct medication use HPS program featured a collaborative partnership between schools, local education authorities, hospital/community pharmacists, and university support networks. Schools implemented the correct medication HPS program based on the six components of the HPS guidelines including school health policies (i.e., adopting correct medication use program); personal health skills (i.e., teaching 5 core abilities of correct medication usage); physical environment of the school (i.e., displaying correct medication use poster in campus); social environment of the school (i.e., conducting correct medication use campaign); school health services (i.e., inviting pharmacists to provide medication consultation); and community relations (i.e., collaborating with pharmacists to implement the program).

Table 1 shows the change in abilities concerning correct medication usage based on the results of the baseline and follow-up surveys for the intervention group. The fifth/sixth grade and seventh grade students’ abilities concerning correct medication usage increased after the implementation of the correct medication use HPS program. For Ability I, >80% of the students reported that they would talk to physicians about their personal health history, whereas less than half of the students reported that they would talk to physicians about the current examinations that they were taking. For Ability II, >80% of the students reported that they would check the medication indications, the amount of medication, the possible side effects and warnings of the medication, the expiration date, and the proper storage of the medication. About 75% of the students reported that they would check the appearance of the medication. For Ability III, two-thirds of the students reported that they would adhere to their medication regimens, whereas about half of the students reported that they would stop taking medicine when they felt better. For Ability IV, >10% of the students reported that they would buy or obtain medication according to family or friends’ recommendations and traditional therapists’ recommendations. For Ability V, about two-thirds of the students reported that they routinely checked the medication consultation phone number on the medication package, and one-third of the students reported that they would save the consultation phone number of pharmacists.

3.2. Comparing students’ abilities as recorded at baseline and in follow-up surveys

Table 2 shows the change in the mean scores of the students’ knowledge and abilities concerning correct medication usage as reported from the baseline and follow-up surveys for the intervention group. The results indicated that after implementing the correct medication use HPS program, fifth/sixth

Table 1 – Students' abilities concerning correct medication usage – intervention group.

	5th/6th graders ^a		7th graders ^b	
	Baseline	Follow-up	Baseline	Follow-up
	%	%	%	%
I. Talk to physicians				
Personal health history	80.3	85.3	82.3	85.4
Current medication use	67.8	77.9	62.8	66.9
Personal allergy condition	63.0	73.3	55.9	60.6
Current exam taking	28.5	47.1	48.2	53.3
II. Read medication packages				
Medication indication	90.6	91.5	89.9	90.9
Appearance of medication	68.1	78.0	76.2	82.2
Amount of medications	80.3	85.6	84.3	89.1
Side effects and warning	82.0	87.5	85.2	88.9
Expiration date/storage	87.0	89.9	86.6	89.7
III. Medication adherence				
Medication compliance	68.8	71.5	62.8	63.3
Stop medication when feel better	46.9	40.1	54.4	50.1
Stop medication when not improved	38.0	35.4	37.2	37.8
IV. Buy/obtain medication from				
Family/friends recommendation	14.1	8.2	14.6	9.6
TV adverts	4.5	3.2	3.6	2.6
Radio adverts	2.4	1.9	2.0	1.2
Internet sale	2.3	2.3	2.2	1.4
Park/temple street vendor sale	2.8	1.9	1.8	1.2
Traditional market sale	4.6	2.7	4.0	3.3
Tour bus sale	7.4	5.1	8.4	6.4
Overseas suppliers	10.1	6.9	10.8	9.1
Traditional therapists recommendation	17.3	11.3	16.1	10.4
V. Consult pharmacists/physicians				
Save phone number of pharmacists	33.8	49.5	34.1	45.0
Be aware of consultation hotline printed on medication package	68.3	71.8	61.9	68.8
Call to pharmacists for consultation	29.7	37.1	25.6	32.1

^a Fifth/sixth graders: Baseline $n = 1951$, follow-up $n = 1860$.

^b Seventh graders: Baseline $n = 1812$, follow-up $n = 1660$.

grade and seventh grade students' knowledge and abilities concerning correct medication usage had increased significantly. For example, there was a significant increase ($p < 0.001$) in the fifth/sixth grade students' ability to express clearly personal conditions to physicians (Ability I; baseline: 0.60, follow-up: 0.71); to check information on the medication packages (Ability II; baseline: 0.82, follow-up: 0.87); to take medications correctly and adhere to medications (Ability III; baseline: 0.61, follow-up: 0.66); not to acquire or buy medication from unlicensed sources (Ability IV; baseline: 0.93, follow-up: 0.95); and to consult with pharmacists/physicians (Ability V; baseline: 0.44, follow-up: 0.53).

3.3. Comparison of students' abilities between the intervention and comparison groups

Table 3 lists the students' knowledge and abilities concerning correct medication usage for the intervention and comparison groups. The t test results indicated that after implementing the correct medication use HPS program, the students' knowledge and abilities concerning correct medication usage in the intervention group were significantly higher than those in the comparison group ($p < 0.001$).

4. Discussion

To enhance teachers' medication education capacity and students' correct medication usage abilities, the Taiwan government launched the correct medication use HPS program in 2009. The present study examined the effect of the correct medication use HPS program. The results indicated that the implementation of the correct medication use HPS program had a positive effect on enhancing students' abilities concerning correct medication usage. A study [23] conducted in the USA also showed that the implementation of safe medication use education had enhanced middle school students' knowledge of safe medication use. A study in Canada showed that HPS implementation was cost-effective in reducing the public health burden [24].

In this program, hospital/community pharmacists play a critical role in strengthening the school and community relationship component of HPS by providing correct medication use training for teachers and students, by cooperatively developing correct medication use teaching content, by conducting correct medication use teaching activities, by providing safe medication disposal teaching and services, and by providing teachers and students with pharmacy store visits. The results of at least two studies [25,26] have suggested

Table 2 – Students' knowledge and abilities concerning correct medication usage at baseline and follow-up – intervention group.

	Baseline		Follow-up		t test	
	Mean	SD	Mean	SD	t value	p
Primary school students (5th/6th grade)^a						
Knowledge	0.79	0.15	0.85	0.15	–13.86	<0.001
Talk to physician	0.60	0.25	0.71	0.28	–13.38	<0.001
Read medication packages	0.83	0.23	0.89	0.23	–7.65	<0.001
Buy/obtain medication	0.93	0.13	0.96	0.12	–6.00	<0.001
Ability	0.68	0.15	0.75	0.16	–12.53	<0.001
I. Talk to physician	0.60	0.27	0.71	0.28	–12.41	<0.001
II. Read medication packages	0.82	0.26	0.87	0.25	–5.96	<0.001
III. Medication adherence	0.61	0.34	0.66	0.34	–3.55	<0.001
IV. Buy/obtain medication	0.93	0.14	0.95	0.12	–5.91	<0.001
V. Consult pharmacists/physicians	0.44	0.34	0.53	0.35	–7.98	<0.001
Middle school students (7th grade)^b						
Knowledge	0.81	0.14	0.84	0.14	–6.72	<0.001
Talk to physician	0.62	0.24	0.66	0.26	–4.50	<0.001
Read medication packages	0.86	0.23	0.90	0.22	–4.38	<0.001
Buy/obtain medication	0.93	0.13	0.96	0.12	–6.03	<0.001
Ability	0.68	0.15	0.71	0.16	–7.23	<0.001
I. Talk to physician	0.62	0.27	0.66	0.28	–4.47	<0.001
II. Read medication packages	0.84	0.25	0.88	0.24	–4.36	<0.001
III. Medication adherence	0.57	0.34	0.58	0.36	–1.07	0.285
IV. Buy/obtain medication	0.93	0.14	0.95	0.12	–4.44	<0.001
V. Consult pharmacists/physicians	0.41	0.34	0.49	0.37	–6.68	<0.001

SD = standard deviation.

^a Fifth/sixth graders: baseline *n* = 1951, follow-up *n* = 1860.^b Seventh graders: baseline *n* = 1812, follow-up *n* = 1660.**Table 3 – Students' knowledge and abilities concerning correct medication usage – comparing the intervention and comparison groups.**

	Comparison group ^a		Intervention group ^b		t test	
	Mean	SD	Mean	SD	t value	p
Primary school students (5th/6th grade)						
Knowledge	0.80	0.14	0.85	0.15	–11.16	<0.001
Talk to physician	0.62	0.25	0.71	0.28	–10.91	<0.001
Read medication packages	0.86	0.22	0.89	0.23	–3.71	<0.001
Buy/obtain medication	0.92	0.15	0.96	0.12	–7.33	<0.001
Ability	0.70	0.15	0.75	0.16	–9.29	<0.001
I. Talk to physician	0.64	0.26	0.71	0.28	–8.04	<0.001
II. Read medication packages	0.85	0.25	0.87	0.25	–3.25	0.012
III. Medication adherence	0.62	0.33	0.66	0.34	–3.36	<0.001
IV. Buy/obtain medication	0.92	0.15	0.95	0.12	–6.73	<0.001
V. Consult pharmacists/physicians	0.48	0.36	0.53	0.35	–4.76	<0.001
Middle school students (7th grade)						
Knowledge	0.81	0.13	0.84	0.14	–5.78	<0.001
Talk to physician	0.63	0.25	0.66	0.26	–4.14	<0.001
Read medication packages	0.88	0.22	0.90	0.22	–2.51	<0.011
Buy/obtain medication	0.93	0.15	0.96	0.12	–6.15	<0.001
Ability	0.68	0.14	0.71	0.16	–6.40	<0.001
I. Talk to physician	0.63	0.28	0.66	0.28	–4.06	<0.001
II. Read medication packages	0.86	0.25	0.88	0.24	–2.67	0.008
III. Medication adherence	0.56	0.34	0.58	0.36	–1.74	0.082
IV. Buy/obtain medication	0.93	0.15	0.95	0.12	–4.13	<0.001
V. Consult pharmacists/physicians	0.42	0.35	0.49	0.37	–5.13	<0.001

^a Comparison group: fifth/sixth graders, *n* = 1995; seventh graders, *n* = 1743.^b Intervention group: follow-up fifth/sixth graders, *n* = 1860; seventh graders, *n* = 1660.

that pharmacists could also teach students about safe medication disposal, over-the-counter medication, and health food. A study conducted in Japan showed the implementation of education intervention by school pharmacists could improve knowledge concerning rational drug use in junior high schools [27]. Disease-specific medication programs could be further developed to enhance medication literacy for students and community adults.

In addition, the present study found that more than one-sixth of the students reported that they would buy or obtain medication according to family or friends' recommendations, whereas more than a third of the students reported that they would stop medication if they felt their condition was not improved. At least one study [28] found that parental attitudes toward medication were associated with how parents medicate their children, including the use of over-the-counter medications and alternative medications. Other studies [29,30] have shown problems with parental self-medication of children and with the misuse of antibiotics. Children of parents with poor health literacy were associated with poor medication adherence [31]. These studies highlight the importance of strengthening parental training of medication literacy in order to reduce children's medication misuse and improve medication adherence. Future correct medication usage programs should extend to family and community members and examine the effects of the program on adolescents and adults.

Teachers are fundamental to the success of implementing HPS programs [32]. However, schools and teachers reported that in implementing an HPS program, there were difficulties such as a lack of capacity, limited class time, and lack of incentives. This program showed the importance of funding schools and recruiting pharmacists to enhance teachers' capabilities in implementing correct medication use HPS programs. To implement correct medication use HPS programs sustainably, schools may also try to integrate correct medication use education into routine school health education, activities, and health services. Ferreira et al [33] proposed six factors that are critical to the sustainability of HPS initiatives: long-term funding, partnership networks, curriculum focus, participant engagement, system-wide change, and action research evaluation for learning and ongoing improvement.

This research had some limitations. First, a social desirability bias may have influenced the truthfulness of adolescents' reports of abilities concerning correct medication usage. However, anonymity was emphasized. Second, the comparison group may have also received correct medication use HPS program information or training through a city/county correct medication use campaign. Third, about 10% of schools participating in the correct medication use HPS program were not included in the data analysis either because they did not complete both the baseline and follow-up surveys or because the number of students who completed the surveys was <10. Fourth, 6% of the students dropped out of the follow-up survey, because they were absent on the follow-up survey day. Finally, this study demonstrated the effectiveness of a correct medication use program on enhancing students' knowledge and abilities, but the effect was measured only for the short term. Future research should examine the long-term impact on students' medication use behaviors and health outcomes.

This study showed that the correct medication use HPS program had positive results in Taiwan. The implementation of a correct medication use HPS program in primary and middle schools significantly enhanced students' knowledge and abilities concerning correct medication usage. Further efforts are needed to strengthen continually the capacities of teachers and to promote the adoption of correct medication use HPS programs in order to enhance students' and parents' correct medication use competency.

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REFERENCES

- [1] World Health Organization. Safety monitoring of medical products: reporting system for the general public. Geneva: World Health Organization; 2012.
- [2] World Health Organization. Promoting safety of medicines for children. Geneva: World Health Organization; 2007.
- [3] McCabe SE, Boyd CJ, Young A. Medical and nonmedical use of prescription drugs among secondary school students. *J Adolesc Health* 2007;40:76–83.
- [4] McCabe SE, West BT, Teter CJ, et al. Medical and nonmedical use of prescription opioids among high school seniors in the United States. *Arch Pediatr Adolesc Med* 2012;166:797–802.
- [5] Wu LT, Pilowsky DJ, Patkar AA. Non-prescribed use of pain relievers among adolescents in the United States. *Drug Alcohol Depend* 2008;94:1–11.
- [6] Department of Health. National Health Interview and Drug Abuse Survey. Taipei: Department of Health, Taiwan; 2011. p. 21–2.
- [7] Department of Health. National Health Expenditure 2011. Taipei: Department of Health, Taiwan; 2012. p. 172–3.
- [8] Organization for Economic Co-operation and Development. Health at a Glance: Europe 2012. Paris: OECD Publishing; 2012. p. 70–1.
- [9] Chang YP, Huang SK, Tao P, et al. A population-based study on the association between acute renal failure (ARF) and the duration of polypharmacy. *BMC Nephrol* 2012;13:96.
- [10] Hsiao FY, Lee JA, Huang WF, et al. Survey of medication knowledge and behaviors among college students in Taiwan. *Am J Pharm Educ* 2006;70:30.
- [11] Wang H-P. From pharmacovigilance to pharmacovigilance planning. *J Taiwan Pharmacy* 2011;27:1–9.
- [12] Chen C, Chen YM, Hwang KL, et al. Behavior, attitudes and knowledge about antibiotic usage among residents of Changhua, Taiwan. *Wei mian yu gan ran za zhi* 2005;38:53–9.
- [13] Hsieh CF, Huang SL, Chen CL, et al. Increased risk of chronic kidney disease among users of non-prescribed Chinese herbal medicine in Taiwan. *Prevent Med* 2012;55:155–9.
- [14] Tsai SY, Tseng HF, Tan HF, et al. End-stage renal disease in Taiwan: a case-control study. *J Epidemiol* 2009;19:169–76.
- [15] Huang YM, Wang HP, Yang YH, et al. Effects of a national health education program on the medication knowledge of the public in Taiwan. *Ann Pharmacother* 2006;40:102–8.
- [16] World Health Organization. Promoting health through schools. Report of a WHO Expert Committee on

- Comprehensive School Health Education and Promotion. Geneva: World Health Organization; 1997.
- [17] World Health Organization. Ottawa Charter for Health Promotion. First International Conference on Health Promotion. Geneva: World Health Organization; 1986.
- [18] Lee A, Wong MC, Keung VM, et al. Can the concept of Health Promoting Schools help to improve students' health knowledge and practices to combat the challenge of communicable diseases: case study in Hong Kong? *BMC Public Health* 2008;8:42.
- [19] Schofield MJ, Lynagh M, Mishra G. Evaluation of a Health Promoting Schools program to reduce smoking in Australian secondary schools. *Health Educ Res* 2003;18:678–92.
- [20] Lee A, Cheng FF, Fung Y, et al. Can Health Promoting Schools contribute to the better health and wellbeing of young people? The Hong Kong experience. *J Epidemiol Community Health* 2006;60:530–6.
- [21] Mukoma W, Flisher AJ. Evaluations of health promoting schools: a review of nine studies. *Health Promot Int* 2004;19:357–68.
- [22] Chi SY, Chang JC, Yeh MK, et al. Enhancing health literacy through developing core abilities of correct medication usage in Taiwan. *J Food Drug Anal* 2012;20:561–9.
- [23] Meadows M. Outreach program to teach safe medicine use to middle school children. *FDA Consumer* 2006;40:9–10.
- [24] Ohinmaa A, Langille JL, Jamieson S, et al. Costs of implementing and maintaining comprehensive school health: the case of the Annapolis Valley Health Promoting Schools program. *Can J Public Health* 2011;102:451–4.
- [25] Abrons J, Vadala T, Miller S, et al. Encouraging safe medication disposal through student pharmacist intervention. *J Am Pharm Assoc* 2010;50:169–73.
- [26] Anraku M, Tomida H, Sato E, et al. Surveillance study on use of over-the-counter drug and health food by school pharmacist for grade-schooler, junior high school student, and high school students. *Yakugaku zasshi* 2011;131:835–42.
- [27] Yamada J, Takayanagi R, Yokoyama H, et al. Survey on junior high school student's attitudes toward rational drug use and the educational effect by school pharmacists. *Yakugaku zasshi* 2012;132:215–24.
- [28] Siponen S, Ahonen R, Kiviniemi V, et al. Association between parental attitudes and self-medication of their children. *Int J Clin Pharm* 2013;35:113–20.
- [29] Bi P, Tong S, Parton KA. Family self-medication and antibiotics abuse for children and juveniles in a Chinese city. *Soc Sci Med* 2000;50:1445–50.
- [30] Edwards DJ, Richman PB, Bradley K, et al. Parental use and misuse of antibiotics: are there differences in urban vs. suburban settings? *Acad Emerg Med* 2002;9:22–6.
- [31] Freedman RB, Jones SK, Lin A, et al. Influence of parental health literacy and dosing responsibility on pediatric glaucoma medication adherence. *Arch Ophthalmol* 2012;130:306–11.
- [32] St Leger L. Reducing the barriers to the expansion of health-promoting schools by focusing on teachers. *Health Educ* 2000;100:81–7.
- [33] Ferreira J, Ryan L, Tilbury D. Planning for success: factors influencing change in teacher education. *Aust J Environ Educ* 2007;23:45–55.